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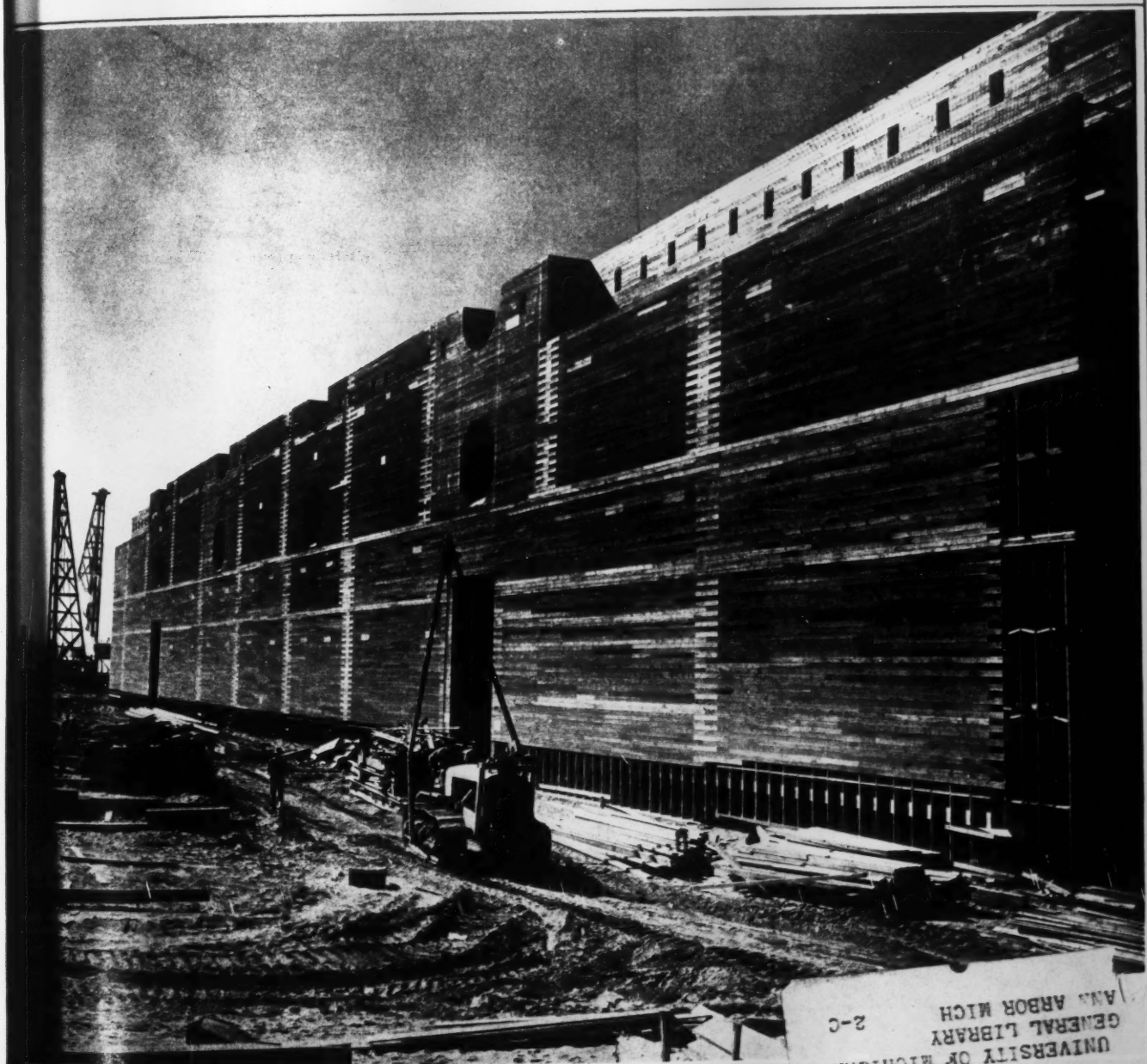

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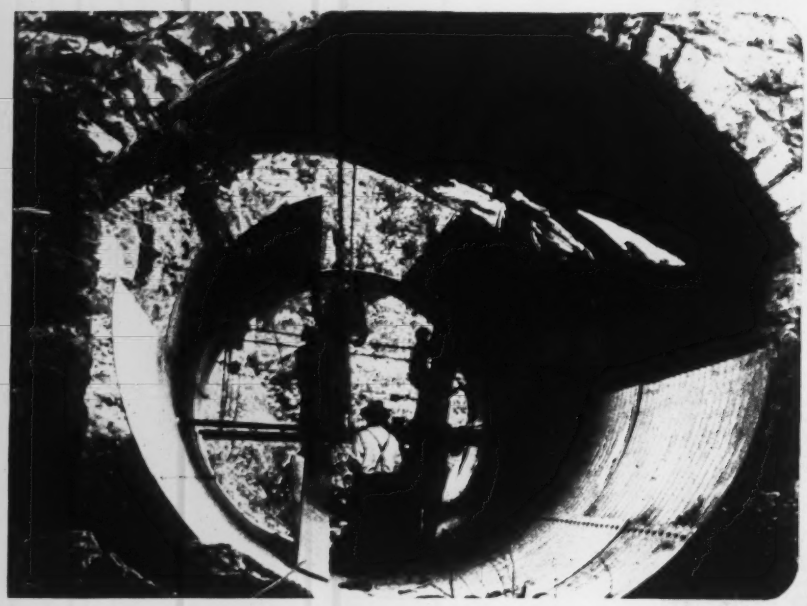

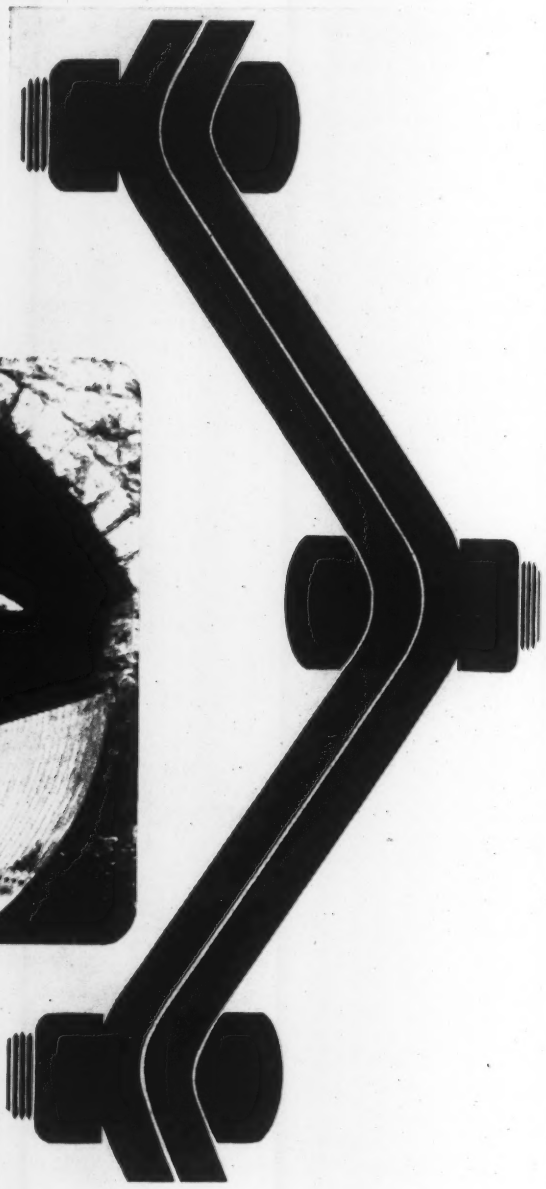

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· ENGINEERING NEWS-RECORD ·

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VOL. 120 *MARCH 24, 1938* NO. 12

THIS WEEK AND NEXT

PREFABRICATING wall panels for large exhibit buildings of timber at the San Francisco fair grounds, as described in this issue, did away with scaffold risks and saved time and money.

Underlying strata composed largely of clays and silts capable of plastic flow are blamed for the failure of Marshall Creek Dam last September.

Accurate cost-keeping is just as important to the small contractor as it is to the larger firms, yet most of the systems and accounting forms in common use are too elaborate and complicated for the small operator. In this issue a Pennsylvania building contractor tells of a cost-keeping system he has developed.

TVA engineers wanted thoroughly to explore the foundation of the proposed Watts Bar Dam on the Tennessee, and when core drills proved unsatisfactory because the materials wouldn't core, they devised a system of dry-hole drillings by large calyx drills through sealed cofferdams.

A considerable part of the Connecticut Society of Civil Engineers meeting last week was devoted to discussion, mostly pro, of the New England Flood compacts.

Staff artists with the Oregon Highway Department produce perspective illustrations which give voters a conception of proposed projects. Examples of this work are shown on page 441.

The discussion of roadways on bridges at New York begun last week, is continued and concluded this week. Floor slab anchorage and expansion joints are among the points covered.

NEXT WEEK. How highway engineers in Indiana speeded paving work by using two paving mixers side by side. Records of from 1,500 to 1,800 sq.ft. were made on a six-mile road.

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THE COVER PICTURE shows a timber exposition building on Treasure Island in San Francisco Bay. Construction is described on page 429.

Number of copies of this issue printed: 33,004

SOMETHING'S HAPPENING to the LITTLE RED SCHOOL HOUSE

● Immortalized in song and poem, the little single-room school house with its pump in the yard, muddy boots in the corridor and its lone instructor teaching the three R's to all grades, is passing from many rural sections.

Rising in its place is the modern, centralized school whose broadened facilities offer greater opportunity for learning to children living in distant areas. » » » »

An important contribution to this new era in rural education is the development of good roads. Busses transporting pupils to and from schools, in all kinds of weather, give testimony to the dependability of the modern highway and to the engineering genius of the road builder. » » » » »

To construct and preserve these valuable roads, highway officials long have recognized the principle of good drainage as being of paramount importance. Drainage authorities agree that drainage structures of corrugated metal pipe are more economical to haul, handle and install and that these desirable features of corrugated metal pipe result in low cost per year of drainage service. » » » » »

When the drainage structure is made of Toncan Iron Corrugated Pipe, long life is assured, because TONCAN IRON is a rust-resistant metal possessing unusual durability. It pays to use "TONCAN CULVERTS" in drainage work. The Toncan Culvert Manufacturers' Association, Republic Building, Cleveland, Ohio.

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THE WEEK'S EVENTS

U. S. Rejects Plan For Power Treaty

Canadian request for treaty covering water diverted to Lakes rejected by Secretary Hull

The U. S. Government has rejected a proposal from the Canadian Government for a special treaty covering the use of water which Canada plans to divert into Lake Superior from the Hudson Bay watershed. This fact was revealed on March 21 when Secretary Hull made public an exchange of correspondence between the two countries.

Flow to be increased

The province of Ontario is now engaged in cutting a channel from Long Lake, one of the headwaters of the Kenogami River, south into a stream flowing into Lake Superior for the purpose of moving pulpwood down to Lake Superior. It is planned to divert about 1,200 sec.-ft. from the Hudson Bay watershed to float pulpwood down to Lake Superior, and the provincial government has asked that a special treaty be drawn up that will permit it to increase its diversions at Sault Ste. Marie and Niagara for power purposes by a like amount.

Full development sought

This proposal the U. S. Government has rejected on the ground that the whole subject of power development in the international river of the border is so closely tied together as to make it inadvisable to single out one case and make it the subject of a separate treaty. The present diversions of water by the two countries for power and navigation are controlled by the Boundary Waters Treaty of 1909. Secretary Hull calls attention to the fact that the question of allocation of water for power development along the international section of the St. Lawrence River is still open due to the failure of either government to ratify the proposed St. Lawrence Waterway Treaty of 1932 and urges that the "mutual needs of both countries can fully be provided for through a jointly planned development of their extraordinary natural resources on the Niagara and St. Lawrence rivers."

The treaty of 1909 permits the diversion for power purposes of 36,000 sec.-ft. on the Canadian side at Niagara and 20,000 sec.-ft. on the American side. This inequality finds its origin in two facts, first, that about 10,000 sec.-ft. was then being diverted from Lake Michigan at Chicago, and, second, that American-owned plants on the Canadian side were exporting substantially all their power to the United States and could continue to export at least half their output under their grant of rights from Canada. Diversions for navigation were not limited by the treaty, nor were diversions through the Welland Canal for power purposes. Diversions at Chicago for sanitary and navigation purposes, though tacitly recognized in prescribing the amount of the diversion at Niagara, were not mentioned in the treaty, as Secretary Root worded the treaty to exclude Lake Michigan from the boundary waters.

Unequal division of water

As diversions for power and navigation through the Welland Canal may amount to 5,000 sec.-ft. the total Canadian diversions may reach 41,000 sec.-ft., whereas the American diversions, with the Chicago diversion cut to 1,500 sec.-ft., total 22,425, giving Canada an advantage of 18,575 sec.-ft. Legislation now before Congress calls for increasing the diversion at Chicago to aid navigation in the Lakes-to-Gulf Waterway.

Secretary Hull in his letter to the

(*Continued on page 418*)

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Road Cut Plan Is Abandoned

Secretary Wallace notifies states to proceed with planning of 1939 projects

When the Secretary of Agriculture allotted $195,000,000 of federal aid to the states the first of this year, he asked the governors not to submit highway projects immediately. He called attention to the fact that the President had asked Congress to cancel the federal-aid allotment for 1939 and that Congress had not yet taken action on that recommendation (*ENR*, Jan. 6, 1938, page 1).

On March 18 the Secretary rescinded this request. He wrote to the governors stating that, "The President now feels that you should not be asked to further delay the submission of the road-building projects in your state, and accordingly I suggest that such projects be now submitted in the order of their priority."

Authorizations in committee

The House committee on roads has about completed consideration of a bill carrying federal-aid authorizations for 1940 and 1941 which will be reported out in the near future. It is understood that the committee will recommend the continuation of federal grants at approximately the present rate.

• • •

Water Storage Begun At Alcova Dam

Water had risen behind the 180-ft. Alcova diversion dam to a depth of 70 ft. on March 9. Water storage behind the dam began Feb. 9, and by March 9, 25,000 acre-ft. had been stored. The dam is part of the Kendrick project at Casper, Wyo.

It is expected that by late April the lake will be raised to a depth of about 135 ft. so that delivery of water to the districts below can be accomplished by means of a spillway as well as the tunnel outlet works. The dam was built by the W. E. Callahan Construction Co. and Gunther & Shirley for the Bureau of Reclamation.

California Storm Toll Total Estimated

Irrigation Districts' Association, meeting at San Jose, hears of flood and drought problems

Edward Hyatt, California State Engineer, summarized estimates of statewide damage of recent storms on March 17 at the San Jose convention of the Irrigation Districts' Association.

Many streams were above previous record heights in December or March, he said, and the floods probably were greater than a 50-year maximum. In the San Joaquin Valley irrigation reservoirs that functioned in a flood storage capacity saved lowlands from additional damage that might have run into the millions. Damage to state highways has been estimated at $8,000,000; public service companies have reported $16,000,000 damage. Eliminating intangibles, actual destruction totals probably will run "considerably in excess of $50,000,000."

Because of the emergency, the recent special session of the California legislature made available $6,000,000 as an emergency fund to be dispensed by the governor. Of this amount $1,000,000 is needed to replace state funds already advanced for flood relief work; the remainder will be available under the governor's direction for repairs to and reconstruction of publicly-owned property. In addition to these state funds, federal aid has made $2,000,000 available to the State Division of Highways; the WPA has speeded up procedure so that loans for emergency flood damage now can be cleared within a week, and requirements of the Disaster Loan Corporation have been modified so that loans to individuals are now available.

California is not yet "out from under" the flood menace: exceptionally heavy snowfall in the mountains is not packed but lies in the form of wet snow averaging, over large areas, the equivalent of a 4-ft. water depth. A warm rain could bring this down quickly in great volume that would, under present conditions of flood reservoirs and stream channels, cause enormous damage.

Santa Clara Works

One day of the convention was devoted to inspecting water conservation works in the Santa Clara Valley, and two papers on the Santa Clara Valley Water Conservation District, by Fred H. Tibbetts, chief engineer, and D. W. Hunt, resident engineer, reported excellent results in replenishing underground water storage depletion of which was becoming an increasing menace until the new works were completed (*ENR* Mar. 10, 1936, p. 361). Recently one of the wells in the area that formerly was artesian has again begun to flow, indicating a very satisfactory replenishment of subterranean storage.

All-American Canal

In a paper by Evan T. Hewes, president, Imperial Irrigation District, the All-American Canal was reported to be ready for water when the diversion works are completed next June. Some 612,000 acres in the district are to be served and the canal ultimately will convey water for 1,000,000 acres. The first power development is to be made at Drop No. 4 a few miles east of Holtville. In contrast with problems elsewhere of lowering water tables, Imperial Valley is giving serious study to the menace of rising ground water levels.

The association adopted a resolution emphasizing the principle that highways can be relocated and storage reservoirs can not: hence, when highways are constructed through proposed reservoir sites there should be an understanding that if relocation is necessary by reason of the development of of water storage, change of location should be charged wholly to the highway and not to the Irrigation District.

Wide World Photo

TORNADOES STRIKE MISSISSIPPI VALLEY

MORE THAN a dozen people were killed and wide property damage was done March 15-16 when a series of tornadoes swept through the Mississippi Valley, causing damage in Illinois, Missouri, Arkansas, Tennessee, Mississippi, Alabama, Louisiana, and Georgia.

Shown above is a scene at Belleville, Ill., which bore the brunt of the damage. Here the twister tore a path two or three blocks wide through the residential section of the town, killing nine people and doing damage which is estimated at about $500,000.

U. S. Rejects Plan For Power Treaty

(*Continued from Page 417*)

Canadian Minister raises anew the question of export of power from Canada, recognizing that Canada will not need additional power for some years to come and so desires to export excess power to the United States. Such export, says the Secretary, unless made on a limited-withdrawal basis, would be detrimental to the best interests of this country. Under these circumstances he holds that a new treaty covering the whole question of power development on the international waters and completion of the St. Lawrence waterway is desirable.

• • •

Big Power Project For Quebec

The Quebec electricity board has authorized the St. Maurice Power Corp. to start construction of a 160,000-hp. hydro-electric development near La Tuque, Que. Preliminary construction work has been under way for about six months, but final plans and financial arrangements had to be approved before construction of the project itself could start.

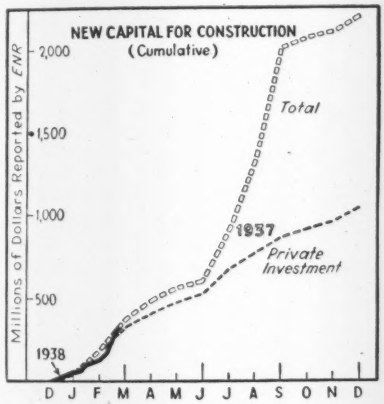
THE CURRENT TREND

This week's news of contract volume and construction cost factors

New Municipal Financing High

Gains 39 per cent above year ago; construction volume up 22 per cent for first eleven weeks

The concentration of investment demands for state and municipal bond issues is reflected by the 39 per cent gain in this type financing in the 11 weeks of 1938 over the corresponding period in 1937. New offerings of municipal bonds, more numerous in the past month, find buyers waiting, and competitive bidding for many issues is responsible for higher prices. Successful bidders report ready sales, and the reserve of bonds available is low. Contrasted with municipal bonds, corporate security issues remain uncertain due to the status of tax bills being discussed in congress, and their sales have dropped 46 per cent under a year ago.



New construction capital for 1938 to date totals $337,605,000, 3 per cent below a year ago, when new financing included $46,562,000 in PWA allotments not present this year. The total includes $187,368,000 in state and municipal bonds; $90,364,000 in corporate security issues; $62,370,000 in RFC loans, $60,000,000 of which was for purchase of Los Angeles Metropolitan Water District bonds. Of the municipal total, $2,497,000 represents a transfer from federal to private financing.

Construction volume ahead

Major engineering construction awards for 1938 to date, $575,027,000, are 22 per cent above the $470,056,000 reported by *Engineering News-Record* for the corresponding period last year, and are the highest for any 11-week start since 1929. Of this total, $262,216,000 is private, 13.5 per cent above 1937; and $312,811,000 is public, 31 per cent above last year.

The public construction total includes $239,733,000 in state and municipal awards and $73,078,000 in federal awards, which are 21 and 80 per cent higher, respectively, than a year ago.

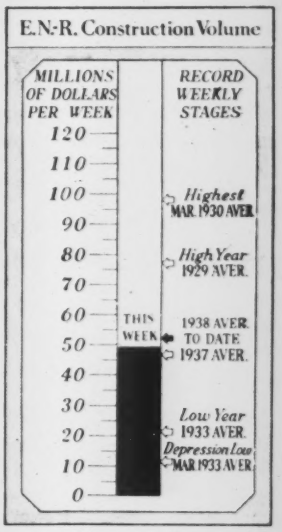
Private construction up

The private construction gain is due entirely to the high commercial building volume, $185,600,000. Commercial building, aided materially by the rush in New York City to file plans before the new building code went into effect, continues at the pace set earlier in the year. During the past month, 15 large office building, large scale housing and apartments projects totalling $52,900,000 were reported in New York City. Industrial buildings account for $52,100,000 of the private total to date, a decline from the high volume of a year ago.

Public awards gain

Public construction gains are more diversified, showing substantial increases in sewerage of 21 per cent; public buildings, 45 per cent; earthwork and drainage, 206 per cent; and streets and roads, 35 per cent. State institutional and school building programs in various parts of the country are responsible for public building gains; Grand Coulee, Mississippi River Dams, and material purchases for Possum Kingdom and Marshall Ford Dams, increased earthwork and drainage awards to three times that of a year ago; and 35 large state highway and municipal paving projects totalling over $31,000,000 are responsible for the highway gain.

Territorial distribution of construction awards for January and February, 1938, compared with a year ago, shows gains of 104 per cent in Far West; 25 per cent in West of Mississippi; and 0.3 per cent in the South; and decreases of 11 per cent in New England; 3 per cent in Middle Atlantic; 6 per cent in Middle West.



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Mar. 25 1937	Mar. 17 1938	Mar. 24 1938
Federal	$4,162	$5,904	$4,117
State & Municipal	19,146	26,810	25,318
Total public	$23,308	$32,714	$29,435
Total private	25,698	20,570	19,714
TOTALS	$49,006	$53,284	$49,149

Cumulative
1938 (12 weeks) $624,176
1937 (12 weeks) $519,062

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 12 Wk.	1938 12 Wk.
NON-FEDERAL	$377,494	$348,957
State & mun. bonds	138,793	195,870†
Corporate securities	192,132	93,164
PWA loans, grants	46,562	—2,497†
RFC loans	7	62,420
FEDERAL		
TOTAL CAPITAL	$377,494	$348,957

† Represents transfer from federal to private investment financing through sale by RFC of PWA bonds.

Business Briefs

Concrete pavement yardage awards for February, 1938, are 48 per cent below February, 1937, as reported by the Portland Cement Association. Road yardage is 49 per cent lower; street, 48.5 per cent lower; while alley yardage is 221 per cent higher than February, 1937. Cumulative yardage total for the 2 months of 1938 is 37 per cent below the corresponding period last year. Reported totals are:

Square Yards Awarded	February, 1938	1938 2 months	1937 2 months
Roads	741,341	2,577,649	4,291,819
Streets	466,331	984,219	1,452,332
Alleys	23,811	45,494	12,072
Total	1,231,482	3,607,362	5,756,223

A. E. Morgan Dropped As TVA Head

H. A. Morgan is named new chairman after A. E. Morgan defies President

Chairman A. E. Morgan of the TVA was dismissed from that position by President Roosevelt on March 22, after he had refused to answer questions from the President about his charges of dishonesty against the other TVA directors and about their charges against him. The President thereupon names H. A. Morgan as Chairman of the Board to replace A. E. Morgan. The President acted on the basis of an opinion of the Department of Justice that he had power to take such a step.

As we go to press, the President is preparing a message to Congress explaining his position in the affair.

This action followed the third of a series of White House conferences at which the President called on the Chairman to produce factual evidence to justify his general charges. On all three occasions—March 11, 18, and 21—Dr. Morgan maintained, in the face of increasing pressure, his original position that only a congressional inquiry could make an "impartial, comprehensive and complete investigation of the authority's affairs."

The first meeting on March 11 (*ENR*, March 17, 1938, p. 383 was devoted to a detailed presentation of Chairman Morgan's charges and a detailed defense by the other two board members, Vice-Chairman Harcourt A. Morgan and David E. Lilienthal. As each count was taken up Arthur E. Morgan refused to present substantiating evidence. Then the charges of the majority against the Chairman were considered, but not answered.

The second meeting, on March 18, developed few additional facts. The Chairman reiterated his previous stand. As the two-hour session approached its close, the President pointed out that on the basis of the record as it then stood Chairman Morgan had failed to sustain his charges. He accused the Chairman of contumacy and posed a direct question whether Dr. Morgan would amplify his charges.

All three directors again reported to the White House March 21, and Arthur Morgan stated:

"Mr. President, since Friday last I have given the deepest consideration to the question you put to me at the end of the session. For reasons which I have given in the two conferences already held, I feel impelled to say that I cannot participate further in these proceedings."

The President then reviewed at length the history of his attempted inquiry, closing with the words:

". . . Arthur E. Morgan's whole attitude toward this inquiry in itself gives credence to the charge that he has been unwilling to cooperate with his fellow directors in the administration of the act and that he is temperamentally unfitted to exercise a divided authority. . . .

"I must greatly consider the position in which Dr. Harcourt Morgan and David Lilienthal find themselves. Some decision on this record is due to them, in all fairness. . . .

"Finally, I must also consider the continuing operations of an important government agency. . . .

"Finally, I must also consider the consequence of permitting the establishment of a precedent whereby any subordinate in the executive branch of the government can refuse to give to his superior or to the Chief Executive himself facts sought in order to straighten out difficulties which he charges exist in his own department. . .

"On that evidence I am obliged to find that: Arthur E. Morgan has failed to sustain the grave and libelous charges of dishonesty and want of integrity which he has made against his fellow directors; his conduct in this respect is legally and morally unjustified. On the face of the record, the charges of the other directors that Arthur E. Morgan has obstructed the work and injured the morale of the organization of the Tennessee Valley Authority must be accepted as true; he has refused to offer testimony in denial of the charges. Arthur E. Morgan is guilty of insubordination and contumacy in refusing to submit to the Chief Executive's demand for any facts upon which he based charges of dishonesty and want of integrity on the part of his fellow directors.

The President then offered Dr. Morgan the alternative of retracting his charges or resigning.

Chairman Morgan: Mr. President, I deny the accuracy and the adequacy and representativeness of the statement you made. I have no other statements to make here now except these: It is my judgment that my resignation at this time would not be in the public interest. Therefore, I do not tender my resignation. I wish also to say that I challenge the suggestion and deny the right and the power to remove or to suspend me."

After leaving the White House Chairman Morgan stated that he had no intention of communicating further with the President, and that he would contest any effort to remove him. His attitude, he declared, was that, "I do not choose to run—away."

Army Approves Big Project

Denison reservoir, Willamette River flood control, and Delaware River deepening are approved

The Secretary of War has transmitted to Congress reports of the Chief of Engineers which recommend construction of the Denison flood control dam and reservoir on the Red River at a cost of $54,000,000, construction of flood control works on the Willamette River at a cost of $43,430,000 and deepening and widening of existing channels in the Delaware River at a cost of $11,000,000.

The proposed Denison dam and reservoir, lying in the states of Texas and Oklahoma, will provide flood protection to valuable farmland in Texas, Oklahoma, Arkansas, and Louisiana.

On the Willamette River in Oregon the Chief of Engineers recommends the construction of a system of reservoirs for flood control, navigation, irrigation, power development, and stream purification. Such channel improvement and contraction works are recommended as may be necessary to secure a minimum depth of 6 ft. as far upstream as the mouth of the Santian River and of 5 ft. from that point to Albany. Reconstruction and enlargement of locks at Oregon City is also recommended. The estimated cost to the United States of carrying out these recommendations is $43,430,000.

A resolution of the Senate committee on commerce adopted in 1935 authorized an investigation of the Delaware River. The Chief of Engineers recommends that the existing navigation project be modified to provide a channel 37 ft. deep from the Philadelphia-Camden bridge to the Navy Yard, thence 40 ft. deep to deep water in the bay. The total cost of new work is $11,000,000, and annual maintenance would be $200,000.

House Denies Funds For Gilbertsville

The House of Representatives on March 22 dropped an appropriation of $2,615,000 from the Independent Office Bill which would have provided for start of construction on the Gilbertsville Dam of the TVA.

The Gilbertsville appropriation had been added to the bill in a Senate amendment, but the House, by a vote of 186 to 157, refused to accept the amendment.

George B. Montgomery Dies, Tunnel Builder

George B. Montgomery, construction superintendent in charge of of driving many of the compressed-air subaqueous tunnels in the New York City area since 1904, died Mar. 16 at Miami, Fla., where he was recuperating from a six-months illness. He was born at Bristol, Pa., Apr. 6, 1880. Mr. Montgomery left his college course at Colgate University to enlist in the Spanish-American War, serving with the First U. S. Engineers in the Porto Rican campaign. Following the war he was engaged in railroad building in Porto Rico for a few years.

In 1904 he became associated with Jacobs and Davies as superintendent of construction of the Hudson & Manhattan R.R. tunnels under the Hudson River. After this job was completed in 1910 he turned to tunnel work in Mexico. Returning to the United States in 1914 he took charge of driving of the Montague and Fourteenth St. subway tunnels under East River in New York. For two years he was general superintendent for the Foundation Co. on deep caisson work, and in 1921 joined Booth & Flinn, Ltd., as superintendent on the Holland Tunnel in New York. From 1928 to the time of his death, Mr. Montgomery was with the Mason & Hanger Co., Inc., serving as superintendent on the Fulton St. and Rutgers St. subway tunnels under East River and more recently on the south tube of the new Lincoln Tunnel under the Hudson. He was recognized as one of the outstanding subaqueous tunnel men of his time, and was known to nearly every compressed-air worker and tunnel engineer in the East. For the past several years he resided at Norwalk, Conn.

• • •

Incinerator Contract Award Enjoined

A temporary injunction to restrain officials of Greenwich, Conn. from awarding contract for construction of a 150-ton incinerator to another firm has been obtained by the Underpinning & Foundation Co., Inc. The company has filed suit seeking a permanent injunction.

The company contends that the town asked for bids on the basis of maximum ultimate economy over a period of years. The low base bid, $156,000, for the work, was offered by the Pittsburgh-Des Moines Steel Co., while the Underpinning & Foundation firm was third with $176,000. The company, however, claims that over a period of 20 years their bid is the lowest bid.

GEORGE B. MONTGOMERY (wearing felt hat) directing a shield shove in the Lincoln Tunnel.

Second Dam Found To Be Unsafe

The Prairie Lee Lake dam in Jackson County, Mo., about 25 miles from the Wyandotte County Lake dam, has been found to rest on unsafe foundations and is being torn down.

After the failure of the Wyandotte County Lake dam, the Corps of Engineers began new tests of the foundation under the Prairie Lee dam and discovered that the earth being used would not make a suitable foundation. The army engineers recommended to the WPA, which is building the dam, that either the base of the dam be widened or that the existing work be pulled out and a gravel, limestone and clay mixture be substituted.

WPA authorities elected to start over, and the 10-ft. high 1,100-ft. long dam base is now being torn out. Because the deadline for completion of the project had been set at July 1, 1938, the usual WPA practice of using a maximum of hand labor is being dropped, and heavy machinery is being used to tear out the old structure and handle the material for the new.

The Prairie Lee project was started nearly a year ago and the cost was then estimated at $400,000. It will create a 170-acre lake and the finished dam will be 1,100 ft. long and 65 ft. high.

Power Authority Seeks To Intervene

New York State Power Authority claims jurisdiction in Niagara controversy

Whether the New York State Power Authority shall be permitted to intervene in a pending proceeding involving the Niagara Falls Power Co. was the subject of a hearing held in Washington March 16 by the Federal Power Commission. The case, which has been pending since 1928, when the company applied for an amendment to its license, involves the disposition of 275 sec.-ft. of flow which the company wishes to add to the 17,725 sec.-ft. it is now permitted to use.

Prof. James C. Bonbright, vice chairman, and George S. Reed, counsel for the power authority, stated that the license at Niagara is closely tied up to the future plans for St. Lawrence River power development by the state of New York. The authority wishes to present to the commission a comprehensive plan to develop 1,100,000 hp. at the International Rapids section of the St. Lawrence. This would be increased by 1,286,500 hp. if Canada consents to an additional diversion of 20,000 sec.-ft. from Niagara. The net return to the state from this combined development is estimated at $30,380,000 per year at the prevailing price of $20 per hp.-yr.

Improper practices

The authority also wishes to present evidence bearing upon alleged mis-use of power under the present arrangement, including excess capitalization, limited distribution, manipulation of surplus power, and the acceptance by the company of contracts for excessively long periods and in other ways inimical to the public interest.

Timothy Cohan, assistant attorney general for New York, represented the State Water Power and Control Commission, which is opposing the intervention. The commission has taken the stand that the state has no objection to the license amendment provided it is paid a suitable rental for the water. At present the state is being paid about $400,000 per year by the company.

Attorneys for the company opposed intervention on jurisdictional grounds and on the plea that this would further delay final disposition of the case.

The jurisdictional question hangs on whether the legislation setting up the power authority restricts its operations to the St. Lawrence only, or whether it also includes tributaries within the state.

Four Men Honored By A.R.E.A.

American Railway Engineering Association makes honorary members of four past presidents

Four past presidents of the American Railway Engineering Association were made honorary members of that organization at its 39th annual meeting held in Chicago March 15-18. The men so honored are William B. Storey, retired president of the Santa Fe; Charles A. Morse, retired chief engineer of the Rock Island; J. G. Sullivan, former chief engineer of the Canadian Pacific; and J. L. Campbell, retired chief engineer of the Northwestern Pacific. This brings the total number of honorary members of the association to eight, the other living members being W. C. Cushing, L. C. Fritch, G. W. Kittredge, and Arthur N. Talbot. Due to illness, Mr. Sullivan was unable to be in Chicago for the presentation ceremonies.

New officers elected

F. E. Morrow, chief engineer of the Chicago & Western Indiana R.R., was elected president of the association succeeding J. C. Irwin. George S. Fanning, chief engineer of the Erie, was elected second vice-president. E. M. Hastings automatically becomes first vice-president. New directors elected are: C. J. Geyer, F. R. Layng, and J. G. Brennan.

W. S. Lacher, whose appointment as secretary of the association was announced early in March (*ENR*, March 3, p. 320), took over his new duties at the opening of the convention due to the illness of Frank McNellis who has been acting as secretary since the retirement of E. H. Fritch last April.

Committees consolidated

A start on regrouping of the committees through which the association carries on all its activities was begun at the meeting this year. Committee I, Roadway, and Committee II, Ballast, are to be combined as Committee I, Roadway and Ballast. Similarly, Committee XVI, Economics of Railway Location, and Committee XXI, Economics of Railway Operation, are to be combined and known as Committee XVI, Economics of Railway Location and Operation. Committee XVIII, Shops and Locomotive Terminals, is to be dropped and its uncompleted assignments are to be allocated to other committees.

The secretary reported that over 1,400 copies of the new Manual which was issued last year have been sold. The association had a comparatively small growth in membership during the year, the total now being 1,938.

A report of the technical proceedings will be published in next week's issue.

Railway show

The Railway Show, held for the first time this year at the International Amphitheatre out at the Stockyards proved to be unusually attractive in its new setting. There were exhibits by 93 members of the National Railway Appliances Association. The fact that the Signal Section, A.A.R., was not meeting concurrently with the A.R.E.A., as has been its practice in the past, reduced the size of the exhibit somewhat.

Few new products for the railway maintenance engineer were on display, but there were many refinements and improvements in types of equipment now in current use.

Among the new products is a tie-puller designed to simplify the difficult task of removing old ties from the track. Also shown was a new type of underdrain supplied either in cast-iron or Vitrified clay, a new type of metal retaining wall, and quick action couplings for temporary air lines.

NEW A.R.E.A. PRESIDENT

PRESIDENT F. E. Morrow of A.R.E.A., is a native of Indiana and a graduate of Purdue University. His railroad service began with the Chicago & Northwestern. Subsequently he was with the Board of Supervising Engineers, Chicago Traction, going to the Chicago & Western Indiana in 1910 as office engineer. Later he became principal assistant engineer, and he was made chief engineer in 1927.

Contracts Approved For Housing

President approves first five Housing Authority contracts for loans to cities

The first actual contracts for housing loans to local housing authorities under the terms of the Wagner-Steagall bill were approved by the President March 17 and are ready to be signed by the local officials. The contracts provide for loans totaling $16,836,000 to five cities for projects which, including local contributions, will cost about $18,700,000.

The contracts cover a loan of $643,000 to the local housing authority in Austin, $1,017,000 to Charleston, $8,411,000 to New Orleans, $3,930,000 to Syracuse, and $2,835,000 to Youngstown. As soon as the contracts are signed by the local officials, money can be advanced and work will start.

The plans presented by the five cities, according to Housing Administrator Straus, provide for construction of buildings with a cost per dwelling unit ranging from $2,500 to $4,000. A sharp distinction exists in land costs between those projects built on the site of existing slums and those built on vacant lands. Cost of land per dwelling unit for the 19 per cent of the dwellings erected on vacant lands averages $411. On the 81 per cent of the new dwellings, however, which are located on existing slum sites, the average land cost is $1,682.

Average rentals to be charged under these contracts range from a shelter rental of $2.75 per room per month in Austin to $4.25 in Syracuse.

Two more states have been added this month to the number of those having laws permitting the setting up of local housing authorities to cooperate with the U. S. Housing Authority with the passage of such legislation by the states of New Jersey and California. In both states the laws provide for the setting up of housing authorities, authorize municipalities to cooperate with local housing authorities and provide for condemnation of land.

• • •

Merritt Parkway Jury Indicts Three Men

The grand jury which has been investigating charges of fraud in connection with purchase of lands for the Merritt Parkway returned indictments March 18 charging conspiracy against G. Leroy Kemp, purchasing agent for Highway Commissioner Macdonald and two real estate dealers.

The grand jury will continue its investigations.

Pressure Aqueduct For Boston Water

District commission recommends $42,000,000 project to improve Boston water supply

A plan to increase the water supply of Metropolitan Boston and to prevent the possibility of pollution of the supply is presented in a special report to the Massachusetts legislature made by the Metropolitan District Water Supply Commission and the Massachusetts Department of Public Health. The plan involves replacing the present grade-line aqueduct east of the Wachusett aqueduct with pressure aqueducts and tunnels and abandoning a number of existing reservoirs.

Filtration of the water supply is not recommended at present, the commission feeling that, though this may be necessary in the future, the greatest present need is to protect the supply from pollution and to improve the distribution system by the use of pressure aqueducts.

The plan involves abandonment of the Chestnut Hills and Spot Pond reservoirs and pumping stations as far as regular service is concerned and direct delivery of water from the Quabbin and Wachusett reservoirs by gravity to the high service reservoirs in the district.

Two-stage construction

Two-stage construction of the project is recommended. An initial stage, which it is recommended be started at once, would cost $12,000,000. The major item in this portion of the project would be 12 miles of pressure aqueduct and tunnel costing $8,800,000. Additional items would be completion of the Sudbury and Happy Hollow siphons of the Weston Aqueduct and sanitary works on the Wachusett watershed.

If started at once, this program could be completed in 1942. Sums remaining from the original appropriations for the Ware-Swift project are believed sufficient to cover the cost of this first stage.

The second stage of the work would cost about $30,000,000. It includes 19 miles of pressure tunnels to complete a loop within the metropolitan district at a cost of $16,500,000, 13 miles of pressure surface conduit from Sudbury dam to the Charles River costing $6,000,000, a 3-mile pressure tunnel branching south from the tunnel loop under Boston, $2,250,000. Reservoir construction and enlargement will also be involved. This work would require several years to complete, and it is believed that the necessary appropriation would be required some time between 1954 and 1957.

The board recommends that the legislature consider the feasibility of undertaking the whole project immediately in view of the current low interest rates and a possible $200,000 annual saving in pumping costs with the completion of the pressure tunnel.

• • •

NLRB Orders Draftsmen To Be Reinstated

The National Labor Relations Board has recognized the Federation of Architects, Engineers, Chemists and Technicians, CIO, as the bargaining agency for all the employees of the Chicago Apparatus Co. The decision provides for immediate reinstatement of three draftsmen alleged to have been dismissed for union activities and payment to them of back pay.

On March 17 the F.A.E.C.T. announced plans for a national conference of federal civil service employees in the navy yards to be held in Washington about May 15.

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Connecticut Society Elects Nettleton

Edward T. Nettleton, of the New Haven Trap Rock Co., New Haven, was elected president of the Connecticut Society of Civil Engineers at its annual meeting held Mar 15-16 at Hartford. New vice-presidents are Charles Rufus Harte, engineer, The Connecticut Co., New Haven, and Frederick P. Stabell, South Norwalk.

Edward W. Bush, past president of the society, engineer of the Aetna Casualty & Surety Co., of Hartford, was made an honorary member, in recognition of his long service to bridge engineering and to the establishment of surety bonding on an engineering basis. Awards for the best papers presented during the year were made to L. H. Beebe and Theodore W. Jones.

Gov. Wilbur L. Cross addressed the society's dinner meeting, speaking of the value of the features of an engineering education and the engineering attitude toward current problems. In a brief reference to the stalemate of the flood-control compacts he said that "playing politics in a matter of this kind is perfectly disgraceful", with evident reference to the holdup of the compacts by Congress.

Three papers by state representatives discussed the flood-control situation and defended the interstate compacts drafted last year and ratified by the states, as being in according with law and established federal precedent. These and other papers are briefly reviewed on another page in this issue.

Ninetieth Anniversary of Boston Society

Boston Society of Civil Engineers holds banquet to celebrate anniversary

Ninety years of service to the profession was recognized by the Boston Society of Civil Engineers on March 16, when a banquet at the Boston Chamber of Commerce followed the usual annual meeting. At the meeting Karl R. Kennison became president, succeeding Arthur D. Weston. Frank B. Walker, chief engineer Eastern Massachusetts Street Ry., was elected vice-president to serve two years. Everett N. Hutchins was re-elected secretary, and Charles R. Main of Chas. T. Main, Inc., Boston, was made treasurer. Directors elected were S. Stanley Kent, assistant engineer locks and canals, Lowell, Mass. and Prof. Frederick N. Weaver, Tufts College, Mass. The guest of honor at the banquet was Col. W. T. Chevalier, vice-president McGraw-Hill Publishing Company, Inc., New York.

Col. Chevalier paid a warm tribute to the long record of the society and to the outstanding leadership of Charles T. Main, who was present at the head table. Discussing the theme, "The Engineer and the Present Trend," Col. Chevalier outlined the transition of America from the period of continental development on a pioneering and speculative basis to an era of scientific industrialism in which lower unit costs gained through engineering skill must be relied upon to secure diffused prosperity. Increasing refinements of method, controlled use of natural resources, widespread research, creative activity, and intensive development of production must be utilized under engineering leadership, the speaker declared, along with appreciation of opposing political and economic viewpoints.

Prize winners

Prize winners in the society's list of authors presenting papers before the membership during the past year were as follows: Desmond Fitzgerald Medal, to Daniel Wood Taylor, associate in soil mechanics, Massachusetts Institute of Technology, "Stability on Earth Slopes." Sanitary Section, to Robert Spurr Weston, consulting engineer, Boston, "Treatment of Wool Scouring Wastes." Designers' Section, to Prof. John B. Wilbur, Massachusetts Institute of Technology, "Model Analysis of Structures." Clemens Herschel Prize, to Charles M. Noble, assistant engineer New York Port Authority, "Factor of Safety in Highway Design."

News continued on page 449

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Wood Pipe Rebuttal

Sir: Your issue of Oct. 21, page 686, stated that the 17½-ft. wood stave pipe, built in 1937 for the Ontario Paper Co. Ltd., was claimed to be the largest in existence.

This claim for the pipe in question was probably first made by our company, but not without first making considerable investigation. There appeared a letter in your issue of Nov. 25 from a New York pipe manufacturing company in which, while they acknowledge a belief that our claim is true in respect to wood pipe in hydro-electric service, they state that they themselves have constructed a short section of wood stave pipe 19 ft. in diameter used for a blending tank.

Again in your issue of Jan. 20th, 1938, a letter appeared from a Portland, Ore., pipe manufacturing company in which, while they agree that the 19-ft. structure is a large pipe, they refer to the fact that they have built three pipes each 20 ft. inside diameter and 120 ft. long, and they exhibit a photo as evidence.

May we be permitted to join this friendly controversy in defense of our claim by submitting that no one of the four 19 or 20-ft. structures is a pipe at all. The first mentioned is acknowledged to be a blending tank, while the photograph shows that the 20-ft. structure has a built-in head at the end.

It becomes necessary to distinguish between a pipe and a tank. We submit that a pipe is used to *convey* water or other liquids *through* it, while a tank having a head at each end carries a stationary load. Our company, too, builds tanks and many of them are built or set horizontally, but they do not thereby become pipes any more than a man, when he lies down, becomes a caterpillar.

The factor of length has some bearing on this controversy. The longest structure produced to challenge our claim is 120 ft. long. By comparison our 17½-ft. pipe, being 5885 ft. long, presents a formidable combination of two-dimension magnitude.

Under the circumstances we feel that, in advertising our pipe as the largest ever built, we have not in any way taken advantage of our friends who have written to your magazine.

GORDON S. SELMAN
Canadian Wood Pipe & Tanks Ltd.
Vancouver, B. C., January 26, 1938

Ducks or Mosquitoes?

The following comments refer to the editorial in the issue of Feb. 24, 1938, p. 291.—EDITOR:

Sir: May I express my appreciation of your editorial stand. Believe me, you have cleared the issue of its smoke screens and called for the question which I am sure will be answered in favor of the masses to whom is due protection from disease and great discomfiture.

L. L. WILLIAMS, JR.,
Sr. Surgeon, Medical Officer in Charge
U. S. Public Health Service
Washington, D. C.

Sir: Your editorial makes me wonder if you are not overlooking many things when you strip this subject of all arguments as mentioned in the third paragraph. I have hunted ducks for the past 20 years in the Middle West and in the South and most of the duck hunters that I have met in the field were not "a privileged few" who were "slaughtering at leisure." Most of these hunters were boys who loved duck hunting probably more than other types of hunting. I have met many other farmers and ordinary workmen, but not so many of the leisure class.

I am an engineer and am very much in favor of mosquito control where it is effective in protecting human life. There are many lakes, however, which can be improved as duck preserves without affecting human life through the breeding of mosquitoes.

One would believe from your editorial that all mosquitoes are carriers of malaria germs. Why couldn't you approach this subject in the middle of the road and encourage the Biological Survey in their efforts to conserve duck life, but point out that a swamp or marsh near a city would be rather out of the question?

S. C. HAMILTON
Birmingham, Ala.

[Only mosquitoes of the genus *Anopheles* convey malaria. Other human diseases are transmitted by mosquitoes, however, among which are yellow fever, oriental sicknesses known as *filariasis* and denuge or "break-bone fever." The latter is prevalent in the South. Sportsmen should also know that certain animal diseases, affecting birds, dogs, and horses, are carried by mosquitoes.—EDITOR.]

Sir: Your editorial is the most sensible statement of this matter that the writer has seen in years. Mosquitoes are a menace to good health, to say nothing of their annoyance.

There is one criticism the writer offers concerning the editorial. You did not make it strong enough! Where there are ten thousand deaths annually by malaria, there must be a hundred thousand cases of it.

ALLAN D. MILLARD
Beardstown, Ill.

[It is reported (*Economic Losses from Malaria*, by A. W. Fuchs, U. S. Public Health Service) that there are about 500 "recovered cases" to every death from malaria; each one of these cases required an average expenditure of $17.30 for medical service and drugs.—EDITOR.]

Sir: My respect for the editorial policy of the *Engineering News-Record* causes me to enter a protest. You refer to "game *refuges* where a privileged few may slaughter at leisure."

No one will deny that public health is paramount, but as I see it, the inference in the above phrase is untrue and unfair and not compatible with the usual position of *Engineering News-Record* in giving the facts and basing any conclusions reached on logical reasoning. Surely, you must know that a great mass of people in this country seem to have an inherent desire to hunt and fish; that each year sees an increase in the numbers who participate in this form of health-giving recreation, and that unless efforts are made to conserve our wild life, there will soon be no place where any-

one can hunt or fish, except "a privileged few."

Therefore, it seems to me that the position of a magazine such as yours should be one that gives proper recognition to, and understanding of, both sides in a controversy of this nature. I think the remainder of the editorial in question is fair, but believe the soundness of your judgment is hurt by the obviously unfair inference referred to.

E. W. ROBINSON,
Vice Pres. McKenzie Construction Co.
San Antonio, Tex.

Sir: Your editorial which super-simplified the perennial argument of "wild life preservers versus mosquito abaters" not only "stripped the argument to the bare essentials" but also stripped practically all the essentials.

Did you suggest the abolishing of drinking water when typhoid was prevalent? Necessity is the mother of invention and as there was no question regarding the necessity of drinking water, a solution to the typhoid problem was soon found. It is now time that the engineering profession recognize the necessity of outdoor recreation and assist the U. S. Biological Survey, the various state conservation departments and the sportsmen of this country in solving the malaria problem instead of assuming the arbitrary attitude as illustrated in your editorial. A proper solution of the problem may make duck hunting available to the average man instead of the "privileged few."

There are many examples of excessive drainage operations, one being in the Kankakee Marsh in northern Indiana. Before drainage this marsh was probably the most famous hunting grounds in this country. During a period of agricultural expansion the Kankakee river was straightened and dredged and many miles of secondary and lateral drainage ditches were constructed. Large areas of good agricultural land have been made available by the drainage operations in the Kankakee basin. Other large areas are not suited to agriculture, much of this land has poor soil, much of it has been over-drained and some is still underdrained. Most of the poor land is habitually tax delinquent and is burdened with ditch construction and maintenance assessments which will never be paid.

The drainage operations have destroyed the attractiveness of the Kankakee Marsh to wild fowl and fur-bearing animals. There still remain, however, large areas of wet land which are still attractive to mosquitoes as breeding places. The confusion of results of the drainage operations in the Kankakee could have been avoided by proper engineering planning and coordination. It would have been possible to have drained part of the land while leaving the remainder in its original state.

An example of the possibilities of utilizing the multiple use value of a marsh without conflict is Indian Gardens. This area of 1,100 acres adjacent to the Kankakee river was originally part of the marsh. After completion of drainage this land was still unsuited for agriculture. A visionary Chicago manufacturer acquired the area and restored it to its former marshy state by constructing dikes and feeder ditches; wild fowl are again finding resting, feeding and breeding grounds there. Yet the activities of the anopheline mosquito in the spread of malaria have not been increased. Adjacent to Indian Gardens is one of the better farms of the area and it has not been damaged by the restoration.

Let us not criticize the efforts of the sportsmen and nature lovers who recommend that marsh drainage projects be kept within "reasonable bounds" without first considering their side of the question. Would it not be better to assist them in coordinating their activities with the efforts of "sanitarians working toward the preservation of public health?"

S. R. SAPIRIE
Indianapolis, Ind.

Sir: You will not be surprised at my 100 per cent approval of your editorial. . . . It is very encouraging to find you supporting opinions which we are in a position to substantiate from honest-to-God field facts rather than from prejudices.

. . . Seacoast mosquito control work should not be classed under the general heading of drainage, as applied to agricultural drainage, because they are entirely different, as you doubtless know. Agricultural drainage is just what the name implies, lowering the water table sufficiently to permit agricultural use of boggy lands. Mosquito control on the tidal marsh areas of the Atlantic coast at least, and doubtless elsewhere in the country, is an almost negligible lowering of the water level (drainage) but is in effect the creation of water circulation by means of ditching through the stagnant breeding marshes, thereby eliminating countless billions of mosquito larvae.

I think much of the original antagonism of wild life enthusiasts was their jumping to conclusions that ditching marshes meant draining them almost to the same extent as highland ditching.

W. S. CORKRAN
Executive Officer and Engineer
Delaware Mosquito Control Commission
Lewes, Delaware

Another Young Man's Position

Sir: The letter "The Young Man's Position" in your issue of Dec. 23 prompts me to write of my own position. I am a graduate of one of the best schools in the East and have had some 15 or 16 years of field experience in construction. Starting as a water boy, I rose to the top as a general manager. I have traveled all over the United States and Mexico and have learned the carpenter, iron worker and electric welding trades. Of course I can read plans, can lay out work, handle men and form an organization.

Though now only 34 years of age, I have been employed as general steel and rigging foreman on such projects as the George Washington bridge, Cape Cod Canal highway bridges, Albany-Rensselaer bridge, Tygart and Fort Peck dams. What has all this got me? Nothing but a lot of experience. I have advertised for four months, have received several answers but only one job—that as a steel foreman which lasted for five weeks.

Pray tell me what do the contractors want? I guess the market must be flooded with a lot of misfits from WPA jobs.

HARRY M. HUNTER
185 First St., Albany, N. Y.

Correction

On the Field and Office pages, 344 and 345, of the March 3 issue, Russell C. Brinker was the author of "Jack Setup for Pile Test" and "Closure of Level Circuit," instead of Russell C. Bimker, as was given on those pages.

ENGINEERING NEWS-RECORD

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LAST YEAR the confusion resulting from overlap of committee assignments in the American Railway Engineering Association was the subject of comment at the association's annual meeting, and the need for a change in the committees through which the association does all its work was urged upon the board of direction. At the meeting held last week President Irwin reported that a start in the regrouping has been made, one committee being eliminated and four others with closely related assignments being grouped into two. This is substantial progress. Experience in handling the present changes should facilitate making other readjustments. Such overlaps as are found in the case of bridge impact, with which three committees are now concerned, obviously call for some form of combination of effort, if confusion and loss of efficiency are to be avoided. The necessary arrangement of work will not always be easy to accomplish, but despite all difficulties it may be hoped that the good work begun this year will be pressed to early conclusion.

Bearing Power

BEARING POWER has changed little in engineering significance during the years. Better means of measuring it have been developed, particularly for the loose soils, and larger and more costly structures make its determination a more exacting task; but fundamental requirements are unchanged. Today as always it is an engineering fault if the question of bearing power can justly be raised after an engineering structure has been designed. Mechanical invention and soil science provide ample resources for safe design, and generally their use is simple. One of the consoling facts of the Marshall Creek dam failure is that investigation after the failure, as briefly summarized on a following page, proves these truths once again. Nothing that was done by the investigation to determine the shortcomings of the foundation soil could not have been done as quickly and as easily before the embankment was designed, and the conclusions drawn would have been almost as certain. Nothing that has been added in the revised embankment design could not have been included in the original design, at a fraction of the cost with which failure has burdened the enterprise. Engineering failed to utilize its resources for ensuring integrity of structure by satisfying the age-old requirement of bearing power in the case of Marshall Creek dam. The redeeming fact is that the negligence is not common; in contrast the methods followed at Watts Bar dam verge almost on excessive precaution.

Making Sure of Foundations

RIVER TESTPITS are a distinct innovation in the preconstruction study of foundations, and the striking demonstration of their use at Watts Bar damsite therefore adds a substantial resource to the engineer's equipment. The sinking method used there is one that under suitable ground conditions permits of obtaining as complete knowledge of foundation conditions as may be desired, through visual inspection, geologic charting, and analysis and test of the materials found. In this work we have before us definite evidence of the forethought nowadays given to foundation questions, and also a recognition of the old rule that one testpit is worth a score of borings. Of course a testpit is no better than the care and understanding with which it is studied. The late Daniel E. Moran, past master in foundations, once remarked that of the thousands of holes in the ground that he had had opportunity to examine he never saw two alike, and each one taught him something new. When a testpit is scrutinized in the spirit of the Moran remark it is a reliable guide to successful foundation construction. The Watts Bar method of exploration gives a ready means for such close observation and scrutiny. Its prime application is to large and heavy structures across bodies of water, but with suitable simplification the essential idea may be made applicable also to smaller work.

Track Research

IT IS ENCOURAGING to find that research into track problems is to be continued despite the depressed condition of the railroad industry. At the annual meeting of the American Railway Engineering Association last week J. M. Symes, vice president of the Association of American Railroads, announced that $107,000 has been allocated to studies in which the A.R.E.A. is interested. This includes the track-stress study which has been in progress for some years and now is nearing a conclusion of its initial program, the costly study of improvements on rail manufacturing processes to eliminate the losses due to transverse fissures, a study of welding methods for continuous welding of rails, a study of end hardening of rails to reduce batter, and some smaller investigations. Some of this work cannot go forward as rapidly as the association would like to see it, and other researches must

wait, but the Association of American Railroads is to be congratulated on continuing its support of the work. And much credit is due to those who have conducted the work so far. It is their skill in producing results that will cut costs for the railroads that has led to continuing the studies.

No More TVAs

REGARDLESS OF THE INQUISITION into the TVA dispute that went on last week at the White House, no one who looks at the sorry mess can escape the conviction that the five year experiment in natural resource development in the Tennessee Valley has failed. It is not an engineering failure; the failure is of men, of administration under an undemocratic system. No purge trial can disguise this failure or make the system attractive for application elsewhere.

The revelations that preceded the judicial rejection of Senator Berry's marble-lease claims, the efforts of the TVA board majority through private agreement to "conciliate" these claims, Chairman Arthur E. Morgan's lone fight for open and honest procedure, and finally the attempt to smear Dr. Morgan and make him a defendant, all are convincing arguments against the attempt to superimpose federal-province government on existing governments and administrative entities. The danger of entrusting irresponsible proconsuls with power over the resources and the welfare of a great region is clearly apparent.

In its origin the TVA had a purpose of great promise—to undertake comprehensive stream development as an experiment to see whether methods of administration and financing suited to the task could be worked out. But this original purpose, it is now evident, was forced into the background almost at the beginning, sacrificed by political fanatics to the desire for creation of a huge public power system. Five years of time and hundreds of millions dollars of expenditure have brought no progress toward developing administrative and financial procedures applicable to river development generally. On the contrary, without the consent of the people of the basin, extravagant expenditure of public funds with no commensurate return went on.

Regardless of this discouraging showing, however, an active campaign was soon begun to set up more TVAs, in order that the whole country might experience a like doubtful benefit. Federalization was to be carried forward by a decisive step. The country was to be blanketed with super-governments, primarily, it is clear, to set up a multiplicity of federal power systems. The TVA experience shows what confusion, waste, and spoliation would result.

No wonder that a New England spokesman declared at Hartford last week: "The people of the Connecticut River Valley do not want a TVA established here." The sentiment he expressed is universal. No state or region wants another TVA. Mindful of the principle that the administration of the people's business must remain in the hands of the people, and observing the outcome of arbitrary super-government in the Tennessee Valley, the citizen prefers the time-tried forms of representative and responsible government.

The objective of stream control and development still stands as a major problem of public administration. But other methods must be used than those which have made so sensational a failure in the Tennessee Valley. Nor need the work be accomplished by wholesale procedure; the TVA failure demonstrates in fact that this way is apt to be unsound and destructive. Those who live in a stream basin are the ones to organize and administer its development, without domination by the federal government. Development may be slower, but it will be sounder—free from the extravagance, scandal and disruption caused by the system that has been tried in the valley of the Tennessee. The country wants no more TVAs.

To Serve the Public

IN RESPONDING to felicitations on the establishment of a department of public works in New York City and the appointment of Gen. E. M. Markham, former army engineer chief, to head that department, Mayor La Guardia recently said that he seeks to build a department to plan all the creative and constructive work of the city. More fitting expression of the reason for effective public-works organization would be hard to achieve.

The physical plant required for public service today and for its extension and modernization in accord with changing needs is large and complex. The productive power of the individual, yes, his life and safety, are largely determined by the structures and operating mechanisms that constitute our public works. A correspondingly heavy responsibility is reposed in the men and organizations who direct the development of our public works. Dispersed control cannot adequately meet the requirements; centralized direction is indispensable. True, for the broader planning, that which needs must look far into the future, it is well to have advisory bodies—planning commissions of general or specialized scope. But specific engineering plans and their execution ought always be centered in one competently manned organization.

That this purpose has been crystallized in New York City, and that it is making progress in state government, gives warrant for the belief that in due course it will also find national recognition.

PICTURES IN THE NEWS

ANOTHER WALL PANEL goes into place for "Vacationland," one of the timber buildings of the San Francisco Golden Gate International Exposition. By building the panels on the ground and placing them in the manner shown, accidents were cut down, and a large amount of scaffolding was eliminated.

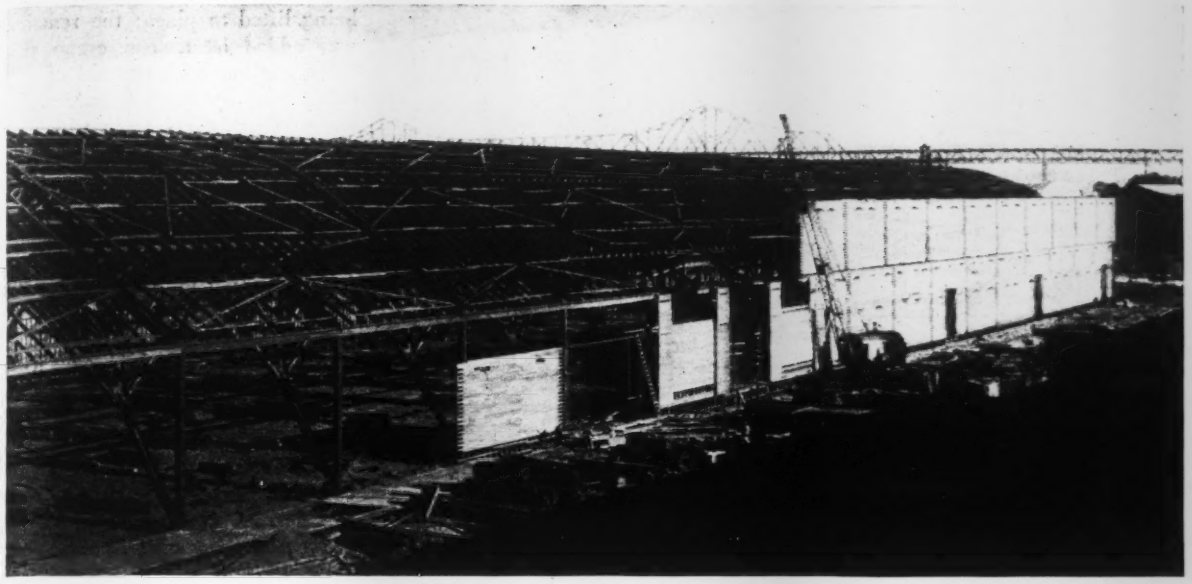

FIG. 1. ERECTION OF SIDE WALL PANELS FOR A BUILDING 200 X 886 FT. IN PLAN

Prefabrication Speeds Wall Erection

Ground assembly of large wood panels for exposition buildings results in less risk to workmen, lower cost and more speed

PREFABRICATION of walls by laying out and assembling on the ground large panels which then were lifted bodily to place, speeded erection on timber Exposition buildings for the Golden Gate International Exposition at San Francisco, and at the same time, by doing away with the necessity for scaffolding, materially decreased costs and the number of accidents. Construction methods were revised, as the work proceeded, to take advantage of experience gained in the early stages of this unusual erection job. Essential features are set forth in the following.

In the construction of the first building, scaffolds were required for all work done above ground level on studding and sheathing. A great deal of this scaffold work was contemplated, as the six main exhibit palaces are 178 to 200 ft. wide and their length ranges up to 886 ft. Wall heights vary from 40 to 80 ft.; wall structure consists mainly of 2 x 6-in. studs spaced 16 to 24 in. and covered with Byrkit sheathing, a specially grooved 1-in. lumber designed for the application of stucco without the use of reinforcing.

In an endeavor to make scaffolds most practical, at the outset they were built as portable structures with skid bases. This plan was abandoned in favor of making up on the ground large wall panels which were then lifted to position by locomotive cranes. When this program was put into effect the accident rate immediately decreased; the majority of accidents up to that point had been caused by falls from scaffolding, and with prefabrication, scaffolds became unnecessary. Although this plan was put into effect with some 90 per cent of the wall erection yet to be done, there were no further major accidents while work on the walls was being completed.

The prefabrication plan was to lay stringers on the ground, place the studding at the proper spacing and nail the sheathing in place. The first panels were made 132 ft. long and hence required a crane at either end for erection. These panels had to be of a height suited to the wall design; that is, the base of the panel was rested upon the sill and the upper end was made to slip under a girt (the 4 x 14-in. timber which at intervals passes horizontally along the walls as part of the building frame). The height from the sill to the first girt varies in different parts of the structure from 22 to 40 ft. Most of the walls proper consist of three lifts; a fourth lift constitutes a setback wall which rests upon the roof. As each panel was set in place it was spiked to the sill at the bottom and to the girt at the top.

After a little experience with the large panels it was found that building up panels in 40-ft. lengths (instead of the 132 ft. previously used) was a more economical method because the smaller panel could be handled by a single crawler crane. This meant less need for coordination of crews and more speed in

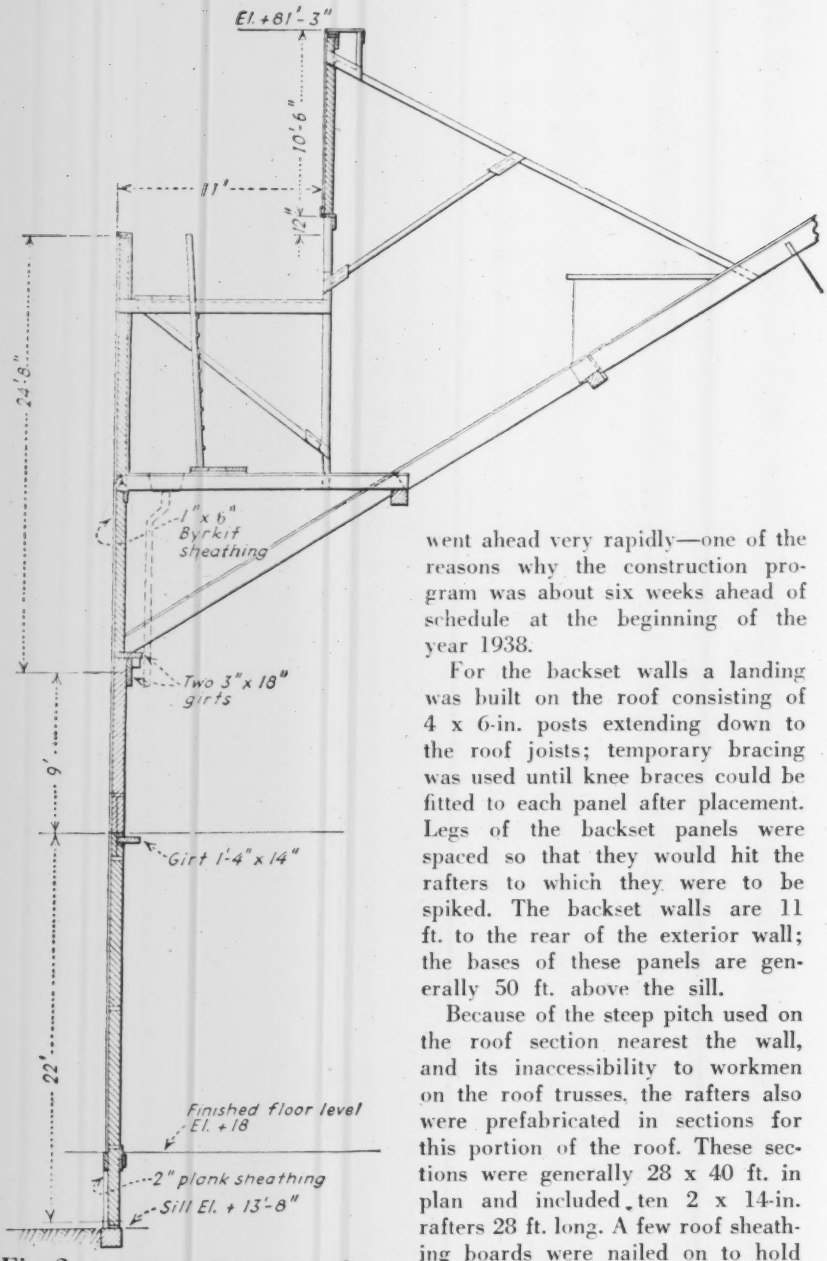

Fig. 2. Typical vertical section of exterior wall showing height and relative location of the four successive panels.

erection. Most of the walls were erected in bays varying from 38 to 42 ft. wide with a crew of four men (in addition to crane operator), two aloft and two on the ground. The cranes had 85-ft. booms; for placing the setback lift on the roof these booms were extended by a 70-ft. timber jib.

Working in this way two crawler cranes and two crews were able to erect 35 panels per day and the work went ahead very rapidly—one of the reasons why the construction program was about six weeks ahead of schedule at the beginning of the year 1938.

For the backset walls a landing was built on the roof consisting of 4 x 6-in. posts extending down to the roof joists; temporary bracing was used until knee braces could be fitted to each panel after placement. Legs of the backset panels were spaced so that they would hit the rafters to which they were to be spiked. The backset walls are 11 ft. to the rear of the exterior wall; the bases of these panels are generally 50 ft. above the sill.

Because of the steep pitch used on the roof section nearest the wall, and its inaccessibility to workmen on the roof trusses, the rafters also were prefabricated in sections for this portion of the roof. These sections were generally 28 x 40 ft. in plan and included ten 2 x 14-in. rafters 28 ft. long. A few roof sheathing boards were nailed on to hold the sections together while they were being lifted to place; the remainder was added later. The crane raised these sections with the aid of a 6 x 6-in timber spreader (similar to that shown on p. 428) from which pennants were attached to several of the rafters.

End wall construction

The general plan of erection used on the longitudinal walls was also applied to the end walls. Here the panels had a double set of 2 x 6-in. studs tied together by girts fabricated with trussed end columns. The double sections were erected in panels 45 ft. long and 65 ft. high, using two cranes with 85-ft. booms. Girders that formed plates and supports for the studs (see Fig. 3) were carefully leveled and fixed at the required elevation before the end panels were placed. In the end wall sections all permanent bracing and bridging was included in the prefabrication; thus, when the panels were lifted to place it only remained to secure them by nailing the plates to girder supports at the bottom and to girts along the top. End walls were tied in to the structural frame of the building with purlin trusses extending to the nearest main arch truss, usually 40 ft.

All construction on the Golden Gate International Exposition is under the general direction of W. P. Day, vice-president and director of works; H. C. Vensano is chief of construction and J. J. Gould is chief structural engineer. Contract for erecting the six main exhibit palaces, involving some 12,000,000 ft. b.m. of timber construction, has been carried out by the Guy F. Atkinson Co., San Francisco; E. L. Kier is in charge of construction of the exposition buildings.

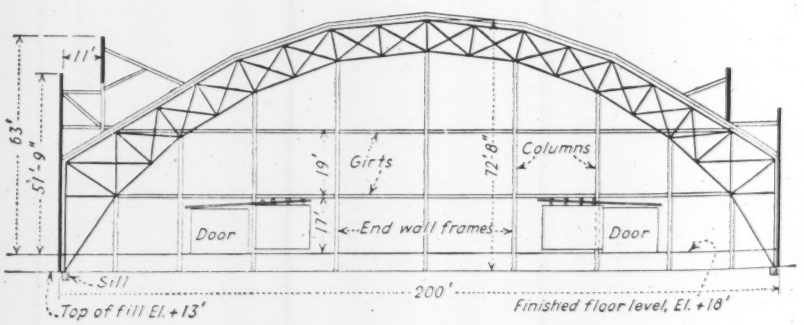

Fig. 3. Cross-section showing panel arrangement on end wall.

Why Marshall Dam Failed

Board of engineers finds underlying strata composed largely of clays and silts capable of plastic flow

Borings and soil analyses made by the board of engineers appointed to investigate the cause of failure of the Marshall Creek dam in Kansas give for the first time somewhat exact details of the foundation soil conditions to which the failure is attributed. Owing to the disturbed condition of the foundation strata due to the failure, the board of engineers report mentions uncertainties in details of the soil test results; of general soil characteristics the findings give an acurate picture as indicated by the section shown, redrawn from charts in the report.

The cross-section of the dam at the time of failure remained to be carried up about 10 ft. to a crest width of 30 ft. General cross-sectional dimensions and slopes are indicated. The final crest length would have been 1480 ft. and the maximum crest elevation 90 ft. above stream bed. The failure was a downstream slump of a moonshaped medial section about 700 ft. long. As described in the engineers report:

The subsidence was confined largely to the area between stations 5+00 and 11+50, extending about 20 ft. upstream from the centerline and 110 ft. downstream. Subsidence of the area near the center of the dam was accompanied by a displacement of the downstream face, together with an upheaval of the lower half of the downstream face and the adjacent ground for a distance of about 130 from the original position of the toe. The maximum vertical subsidence along the crest was about 47 ft. near station 8+00. The upper berm on the downstream slope at El. 807 was moved northward about 32 ft. and lowered 12 ft., whereas the lower berm originally at El. 779 was shifted 48 ft. and remained about at the original level. The ground downstream from the dam was raised 14 to 20 ft. above its original elevation. The present slope of the downstream face in the failure section is about 1 on 7.

The lines of fracture along the crest of the dam paralleled the axis for a distance of about 500 ft. and extended diagonally to the downstream toe at each end of the failure section. A secondary fracture area having a similar crescent shaped pattern was present in the downstream slope in the general region of the upper berm (El. 807). The larger crevices near each end of the failure section could be traced almost to the toe. Several tension cracks having the same general pattern as those on the downstream slope were present in the upstream slope near the upper berm. The planes of rupture in the region of maximum subsidence are nearly vertical. There was only a small volume of water stored in the reservoir at the time of failure, the elevation of the lake being at 770 ft.

The dam is in a limestone gorge bedrock which forms the valley floor with an alluvium overburden. The and underlies both abutments is a series of almost horizontal layers of limestones and shales. The shale and limestone are hard in their natural, non-weathered state; no evidence of faulting is apparent, and no reason is evident for assigning any part of the cause of the dam failure to the rock foundation.

A mantle of wind-deposited loess soil, with a maximum thickness of 50 ft., covers the rock foundation on the right abutment at the axis of the dam. In the valley bottom are noncontinuous layers of soil composed of clay and silt in every possible mixture. It is evident that the bottom soils are heterogeneous mixtures of loess and disintegrated shale and limestone that have been washed into their present arrangement from the uplands by varying erosive conditions.

What borings showed

Underground explorations were started on Sept. 26, 1937, and was completed on Dec. 21, 1937. The efficient and expedient completion of a program was handicapped by conditions at the site, particularly the presence of large limestone rock in the random fill of the downstream shell, the lack of sufficient previous foundation explorations to aid in identification of the original foundation soils, and the unstable embank-

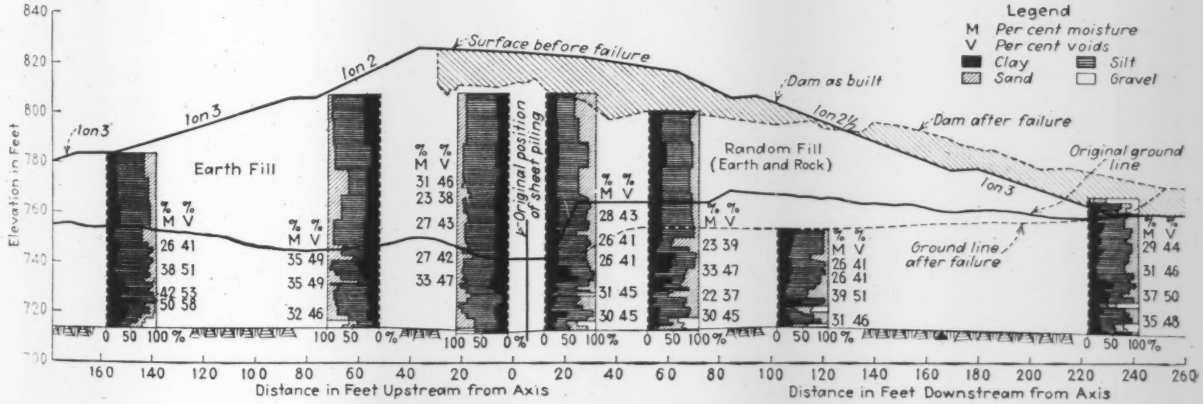

Fig. 1. **Cross section of Marshall dam showing combinations of soil qualities indicating certainty of plastic flow under load.**

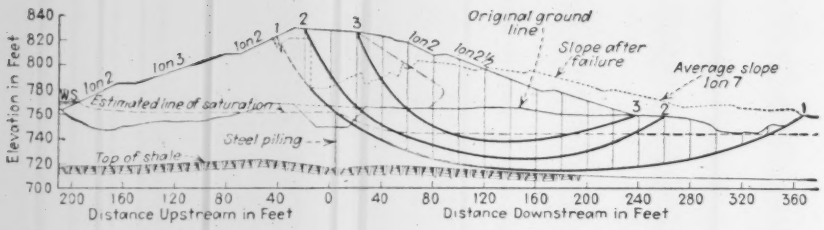

Fig. 2. Stability analysis of dam based on method developed by the Swedish Geotechnical Commission.

ment that precluded the construction of test pits for securing undisturbed soil samples. Exploratory holes were spaced at 100 ft. to 200 ft. centers over the embankment and in the valley for a distance of 700 ft. upstream from the dam. Three representative sections at Stations 6+00, 8+00 (see illustration) and 10+00, each cutting the disturbed region, were selected for detailed study and additional holes were driven along these stations to amplify data on subsurface conditions.

Casing was required in almost all of the holes. Soil was removed from the holes by driving a 2-ft. length of steel tube, equipped with a cutting shoe having an inside circumference flush with the interior circumference of the sample tube. A 3-in. tube was used for securing mechanical analysis and identification samples, and a 6-in. tube was used to obtain samples from which 4-in. square sections could be obtained for shearing strength and consolidation tests.

An examination of the samples secured for shearing strength and consolidation tests shows that the equipment used was not suitable for general sampling of soils; it was practically impossible to recover the saturated foundation clay loam and silty loam samples without completely destroying their shape.

Using the classification of the U. S. Bureau of Chemistry and Soils, the results of mechanical analyses have been plotted on cross sections perpendicular to the axis of the dam (See illustration). The percent moisture by dry weight and the percent voids are indicated along the side of the graphs at the depths where the determinations were made. It is evident that the foundation of the dam contains a high percentage of clayey soils; soil containing 40 to 50 percent clay (particle size less than 0.005 mm) was found at many locations and a soil with 80 percent clay was found at Sta. 8+00, 230 ft. downstream. It is to be noted that many of the foundation soils still contain almost 50 percent voids after having been subjected to a gradually increasing embankment load for a period of from 12 to 18 months.

Because of the fact that the soils comprising the embankment (that is, loess or reworked loess) were of the same origin as the surface of the original ground, it was difficult to locate accurately the surface of the original ground from an inspection of the soil samples. Examination of the soil profiles shows that after the failure the region 100 ft. downstream is particularly lacking in the richer clay soils. The failure of the dam resulted from a plastic movement of those foundation soils deficient in shearing strength in the region about 100 ft. downstream from the center line. The plastic movement was caused by overloading of the foundation by a combination of height of dam and steepness of slopes.

Discussion of stability analysis

In selecting a method for making a stability analysis of the dam, as originally constructed and as contemplated for reconstruction, an effort was made to choose one that satisfied the several conditions with the minimum number of assumptions. The slice method of stability analysis developed by the Swedish Geotechnical Commission was adopted after a study of the applicability of the various known methods. The first step in the analysis of the failure was the computation of the required shearing strength along the surface where the strength-stress ratio is a minimum; that is, the values of c and tan ϕ required in the foundation soils for equilibrium of the original section. Several combinations of values for c and tan ϕ were determined that just produced equilibrium. A comparison of these combinations of shearing strength constants with the constants determined by laboratory tests on foundation soils gave the apparent factor of safety at failure.

The results of the stability analysis of the original section are shown on Fig. 2. It was found by trial that curve No. 2 represents the plane requiring the greatest average shearing strength and that the equation for equilibrium is ($c + 3.03 \tan \phi = 0.55$ T/sq.ft.), where 3.03 tons per square foot is the average normal load on the curved surface and the value 0.55 tons per square foot is the average shearing strength required along curve No. 2 for equilibrium. The average shearing strength of the more plastic soils in the foundation of the original dam was determined as $c = 0.16$ T/sq.ft. and $\tan \phi = 0.10$ from a weighted average of the shearing strength of all samples taken under the dam, ignoring extreme values and values for gravel or sandy areas. The average values of $c = 0.16$ and $\tan \phi = 0.10$, applied to curve No. 2, with an average normal load of 3.03 tons per square foot, would develop a shearing strength of 0.46 tons per square foot ($0.16 + 3.03 \times 0.10 = 0.46$ T/sq.ft.). The shearing strength required is 0.55 T/sq.ft. for equilibrium. Therefore, the apparent factor of safety at failure was $.46/.55 = 0.84$. However, the actual factor of safety must have been only slightly under 1.00.

Members of the board of engineers were: H. L. Reppart, director of WPA operations, chairman; R. E. McDonnell, of the Kansas City firm of Burns & McDonnell, consulting engineer representing Wyandotte County; G. A. Hathaway, principal engineer, U. S. War Department; and R. V. Smrha, assistant engineer, Kansas Division of Water Resources.

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Milwaukee Water Use

THE 1937 daily per capita water consumption in Milwaukee, Wis., as reported by H. P. Bohmann, superintendent of waterworks, was 135 gal. with the total average pumpage for the city and suburbs of West Allis, Shorewood, Whitefish Bay, West Milwaukee and county institutions at Wauwatosa 93.8 m.g.d. Aug. 16 at 146.7 the peak day. Revenues were $2,530,000 of which $600,000 was transferred to the general fund.

Simple Cost-Keeping System For Small Contractors

by CARL V. HOBAUGH
Building Contractor, Butler, Pa.

Pennsylvania builder keeps weekly payroll and job expense data on folding sheet that eliminates time books

THE design of an accounting system for contractors, or the revision of an existing one, is a professional problem requiring experience and a technical knowledge of accounting principles beyond the capacity of most small contractors. Therefore, the writer suggests that such work be entrusted to a trained accountant, especially if the system is to be operated by those lacking in accounting knowledge. Yet the cost-keeping requirements of the smaller building contractor are often unfamiliar to the accountant, so the contractor usually must take a hand in devising a system of record keeping that meets his particular needs. After many struggles with the cost-keeping problem of the small contractor, the author has developed a simple system for his own use that is proving very satisfactory.

Much has been published on the subject of construction accounting, and the larger firms able to employ cost engineers and accountants have their cost systems well developed. Some of these systems are far too elaborate and costly, and very few are adaptable to the needs of the smaller firm. The small contractor is limited in his overhead allowance, usually a stenographer and a bookkeeper constitute his clerical staff, and he has neither the money to spend nor the technical assistance available to operate any but the very simplest of cost-keeping systems.

For the small operator, the requirements of a cost-keeping system are few but important. It must provide adequate information for a quick and thorough analysis of all costs, data for future estimating, and material for furnishing the owner with detailed cost statements. All of this information must come from field and office records compiled by a personnel having little understanding of the results desired.

With these requirements and limitations in mind, the author has developed the combination payroll, time distribution and expense sheet shown in the accompanying illustration. It is the result of many trials and errors, and the author realizes it is still far from perfect.

Details of the form

The form is made by turning the end of the sheet of paper back upon itself to make a second leaf, somewhat shorter than the main leaf. It is perforated at the crease so the two leaves may be separated for filing, and is also punched to fit a standard binder.

These time sheets instead of a time book are given to the person in charge of each particular job, usually one of the older employees, and about all the help he will need is to have a list of the subdivisions to be made of the time. For jobbing work and for similar small jobs these time sheets are, more or less, a nuisance, and a time book or some similar method is better.

The payroll page is a standard form and needs no explanation. However, if a more complete record is desired, all on this one sheet, the sheet might be rearranged or columns added to provide for additional information, such as the social

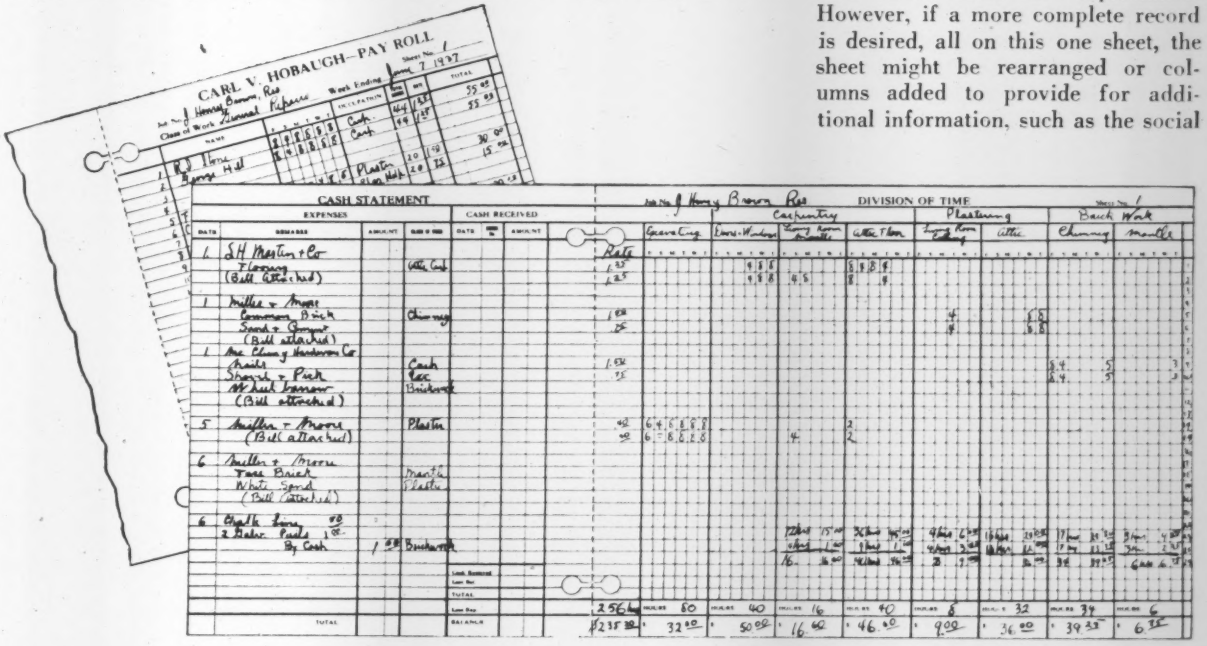


Fig. 1. Simple payroll and job expense form which is a cost-keeping aid for the small contractor.

security numbers of the employees, social security tax deductions and the resulting net payroll. The numbering of the lines on both the payroll and distribution page is a great help and really should be printed on the form. At the end of each day as the time is set down the timekeeper also divides the time into the proper columns on the distribution page, being careful to place each worker's time on the same line as it appears on the payroll page. In this way the time of each man is on the same line throughout both pages of the report and is easily checked.

Having the time and distribution, it is a simple job for the office force to figure the payroll and balance the hours and costs on the distribution page. In figuring the distribution sheet, we find it is of help to transfer the various hourly rates to the edge of this sheet on the proper line, as shown in the accompanying illustration, but this is not entirely necessary. We have also found that it is better to use more than one form if there are not enough columns to subdivide the work properly, rather than to enlarge the distribution sheet.

The form on the back of the payroll page is intended primarily for the cash statement of the superintendent on an out-of-town job, and is designed to show the money he receives from the office, what he does with it, and to what part of the work it is to be charged. The bottom of this sheet is arranged to show the weekly cash balance. We also use the same form as a material record on many of the smaller jobs.

Plan Increased Planting For Shelter Belt

In six states 4,300 miles of shelter belt planting of trees have been allotted for 1938 by the U. S. Forest Service; this is about 60 per cent more than were planted in the three previous years. A total of 125 miles of shelter strips was planted in 1935 together with about 6,500 acres of solid planting. The 1936 and 1937 shelter strip plantings were 1,152 and 1,329 miles, respectively. Plantings under the projects, authorized by Congress last year, are a continuation of shelter belt planting begun in 1935 with emergency funds.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Air Brush Stipples Tracings

FRED J. HERRING
State Manager, State-Wide Highway Planning Survey, Little Rock, Ark.

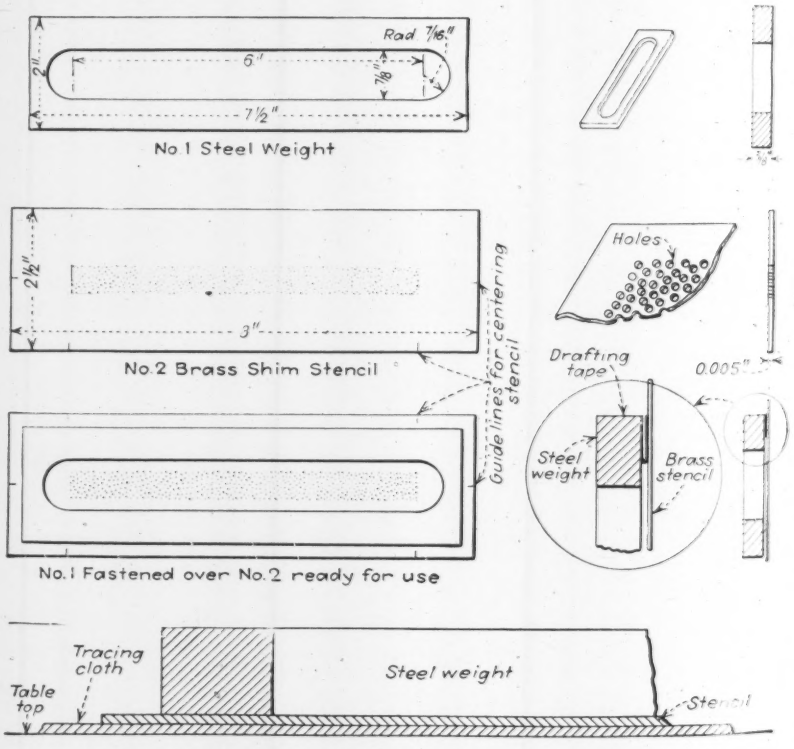
A method has been developed in the drafting room of the Arkansas state-wide highway-planning survey of emphasizing areas or boundary lines by stippling on the back of tracings with an air brush. This method is rapid and economical and more satisfactory than any other tried. Three types of stippling, (a) incorporated areas; (b) township boundaries, and (c) U. S. government reservations, are used.

Considerable experimental work was necessary before uniformly satisfactory results were obtained. The stencil which was finally developed is made from shim brass 0.005 in. thick through which holes of any desired diameter and spacing are drilled. The drills used were made in the state highway shops from steel needles which were placed in a high speed motor tool lathe and ground with a stone to the desired diameter. The diameter must be uniform and the point pyramid shaped.

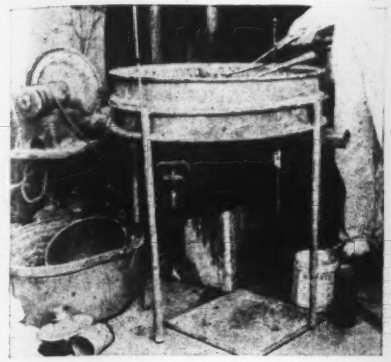
It is very essential that the stencil be held tightly against the tracing or the stipple will be smudged. Iron or steel frames made from junk material furnished the necessary weights and the stencils were attached to these with drafting tape.

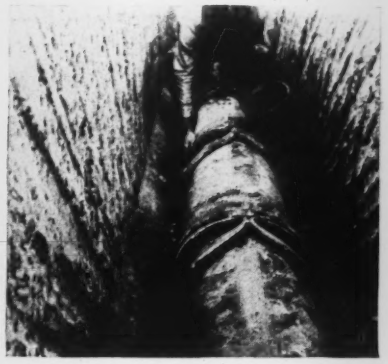
Details of the stencils and weights used are shown by the drawing. The brass shim should be slightly larger than the weight and should be scored on the ends on the center line and on the sides opposite the end of the cut stencil to facilitate centering.

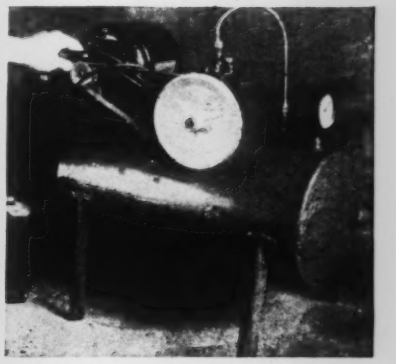
Any portion of the cut stencil may be temporarily blocked by covering it with scotch tape. A cigarette paper placed over an area already stippled prevents the next section from overlapping. Speed is gained in stippling along irregular boundaries by using a short, wide stencil which is placed and stippled in successive positions



Details of stencils for stippling tracings with an air brush







Camera Memoranda of Construction Aids

1. FORGE FROM OLD RIMS—Two old automobile wheel rims with a steel plate bottom and legs of scrap tubing all connected by welding, provide an excellent forge for a field blacksmith shop.

2. HOSE JOINT PLUG—When laying concrete pipe, sections of old garden hose, drawn around the pipe and fastened at the top, hold the grout in the bell end of the joints. When the grout has set a pull on one end frees the hose.

3. IMPROVISED COMPRESSOR UNIT—When a small compressor is needed, construct a tank from old pipe, welding up the ends and welding legs of scrap metal to the bottom, and mount the compressor on top. The unit can be easily moved about as required.

along the irregular border without regard to uniformity in width. The excess stipple is then deleted with an electric erasing machine. Standard black drawing ink is sprayed with a Passche Type M.S. air brush. Liquid carbonic gas was found to be more satisfactory than compressed air. This method was developed under the direction of D. M. Tate, Analysis Manager.

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Device for Testing Paint Coats

DANIEL MCFARLAND
Mason City, Wash.

At the Grand Coulee Dam there are about forty or fifty carloads of metal work such as the trash-rack structure, conduit linings and gates, that is to be placed where it will be permanently under water. The exposed parts of this metal are painted with a bituminous enamel. To be sure that all parts of the metal are painted to the required thickness a device was developed by the U. S. Bureau of Reclamation engineers quickly and accurately to test the thickness of the paint.

The device consists of a box with a set of batteries and a coil to increase the voltage. Leading from the box are two wires, one a ground wire which is attached to the frame to be tested, and the other (the positive wire) attached to a broom. The broom has a lightweight wooden handle which is hollow. The wires go down through this and are connected to bristles of steel about 3 in. long. One broom is about 3 in. wide and the other about 6 in. wide. The broom is moved along the painted surface, when any place that has less than the required thickness of paint is encountered the broom indicates it by tiny sparks and a buzzing noise from the coil in the box.

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Dump Trailer Aids Sewer Gang

A two-wheel trailer has been found a very convenient piece of equipment for small sewer maintenance crews in Los Angeles. Such a rig, coupled to the light truck which transports the maintenance crew, often avoids the necessity for sending a dump truck to pick up small scattered loads. The trailer thus eliminates the cost of this second or cleanup operation and avoids leaving the debris on the street pending arrival of the pickup truck.

A recent improvement to the original rigid-body trailer is the inclusion of a hinged mounting and a hand crank which makes it possible to dump the load by tilting the body on the chassis frame rather than by inclining the trailer unit as a whole.

Sewer maintenance work in Los Angeles is under the supervision of H. P. Cortelyou, deputy engineer. Lloyd Aldrich is city engineer.

Dump trailer enables sewer maintenance crews to clean up as they go

FIG. 1. DRY-HOLE EXPLORATION OF TENNESSEE RIVER BED IS MADE WITH THE AID OF CALYX DRILLS

Underwater Exploration with Calyx Drills

by HENDON R. JOHNSTON
Associate Hydraulic Engineer, Tennessee Valley Authority

Site of Watts Bar Dam on Tennessee River investigated by large bore holes sunk in midstream through sealed cylinder cofferdams

TO EXPLORE THOROUGHLY the bed of the Tennessee River at the site of the proposed Watts Bar Dam, Tennessee Valley Authority engineers developed a system of underwater boring with calyx drills inside sealed cofferdams that provided large holes as deep as desired for visual examination of the foundation strata in place. The site of the dam, the second project downstream from Knoxville in the TVA scheme for continuous canalization of the Tennessee, presents a foundation problem different from that encountered on any other project in the development. The problem is not one calling for extensive treatment of the foundation to prevent passage of water beneath the structures, but is one of designing the dam and locks to obtain suitable bearing pressures across foundation strata of widely varying hardness and compressibility.

The foundation is in the Rome formation, which at this particular location varies from a compacted fissile shale, with little or no binder material, to a very dense and hard siliceous sandstone. The rock occurs in laminated form, ranging from interbedded laminae of the two materials only fractions of an inch thick, through various reversible gradations to beds of either of the individual materials several feet in thickness. The formation, although very highly folded in some areas, has an apparent general dip of 35 deg. in the downstream direction and an apparent general strike 45 deg. off the direction of the axis of the dam. Fig. 2 shows a section of an anticline which outcrops about 1,000 ft. upstream from the right abutment of the dam site. From the above direction of strike, it is seen that the individual beds of foundation rock will cross the excavation diagonally, and it is this transition point which presents the design problem.

A rather extensive exploration program by the diamond drill method was carried out in 1936, but core recovery in the uncemented shales was very poor and it was impossible to determine the exact extent or the probable compressive strength of the more shaly materials. It was decided that exploration shafts sunk into the zones where the material was predominantly shale would afford valuable information regarding the suitability of the foundation. Elevations of the two adjacent projects and existing reservoir rim restrictions, plus suitable topographic conditions at this particular site, make it very desirable to locate the dam at or near this point.

One of these shaly zones would cross the proposed spillway structure about midstream; thus it was necessary to put three or more of the shafts in the river. Since the diamond drill explorations had shown that there were no open cavities or seams in the rock formation, it was thought that there would be no serious leakage if a suitable seal could be obtained at top of rock.

The calyx drill method of exploration was chosen because of the excellent exposures of the materials in

positively undisturbed condition, which are afforded by this method.

The items of equipment selected for the project included one 24x100-ft. steel barge, one WS-3 calyx drill with auxiliary hoist, one 220-ft. portable compressor, one jackhammer rock drill, one 2-in. water supply pump, two air-driven sump pumps, one two-drum gasoline-driven hoist, one 1,500-watt lighting plant, and the necessary hose, pipe and other auxiliary tools and equipment.

Two 12-in. I-beams were bolted to the deck of the barge 6 ft. apart and extending 10 ft. beyond the downstream end of barge. On these cantilevers the drill and working platform were mounted, thus allowing the drill head to maneuver as much as 3 ft. downstream from end of barge. Fig. 1 shows this drill in operation.

Two large anchors were planted some distance upstream from the proposed axis of dam and far enough apart to allow the barge to be shifted across the stream. Brackets were bolted to sides of barge at each corner to accommodate 8x8-in. timber spuds. The barge was maneuvered into position by manipulation of cables fastened to the anchors and working on the drums of the hoist, after which the spud members were dropped through the brackets to rest on the river bottom, thus eliminating minor lateral movements due to wind and wave actions.

As the average low-water depth of the river at this location is 8 ft., and the average velocity is 6 ft. per sec., it was necessary to provide a stable cofferdam seal. A 54-in. cylinder of 5/16-in. steel plate, fitted with removable head plate bolted into the top end, was fastened to the drill connection flange. The cylinder was lowered through a wooden guide frame, and rotated through the 2 ft. or so of overburden, and about 3 ft. into the rock. This cylinder was slotted at the bottom after the usual pattern of a calyx drill bit and was used exactly as such a bit, except that when the desired 2 or 3 ft. of penetration in rock was obtained, the bolted head was removed and the cylinder was driven hard to the bottom by dropping a heavy calyx bit several times onto timbers laid across the top.

The cylinder was then unwatered by the sump pumps and all material was mucked out to the bottom. Next,

Fig. 2. Outcropping anticline upstream from dam site indicates nature of foundation formation. Desire to inspect these strata in place at the dam led to development of the calyx drill exploration method.

a concrete plug about 18 in. thick was poured into the cylinder for a water seal. It was found that the best and quickest seal could be obtained by using equal parts of quick-set and standard portland cement, with sand added in the amount of one-fourth the total volume. To prevent percolation through the grout mixture during the setting period the cylinder was filled with water to the level of the water in the river. Such a plug was solid enough to stand being drilled through after setting for 48 hr.

After the cylinder had been set and sealed in the above manner, the drill head was again moved over the center of the cylinder and drilling was begun with a 40-in. calyx drill bit. When the 40-in. bit had drilled through the concrete plug and about 10 ft. farther into the bedrock, the geologists and engineers were called in to inspect the walls of the hole. They saw the rock to be excavated and probable zone of finished foundation in natural and undisturbed condition. The shaly rock would not core even with this large bit and most of it was barred loose and shoveled into muck buckets.

A 20-ft. section of 39-in. steel cylinder was then lowered to the bottom of the hole, and the annular space between this cylinder and the wall of the hole, and back to the 54-in. cylinder, was filled with fine sand. This was to guard against overturning of the larger cylinder in case the river rose an appreciable amount and it became necessary to add extra lengths to the casing in order to allow the operations to continue undisturbed. Work has been carried on undelayed throughout river stage fluctuations of 10 ft., and doubtless 15-ft. fluctuations would cause no trouble.

After setting the inner or supporting casing, the holes were carried down with 36-in. calyx bits to varying depths up to 68 ft. of penetration into bedrock. Fig. 3 shows a detail of the cofferdam and water seal that made dry drilling possible far below the riverbed.

Inspection in the dry

The field geologist inspected the hole twice a week and kept a very accurate progress log sketch of the walls of the hole, showing thickness, dip, and strike of individual strata and noting particularly all joints, folds, faults, or other unconformities. The top or some lower joint in the

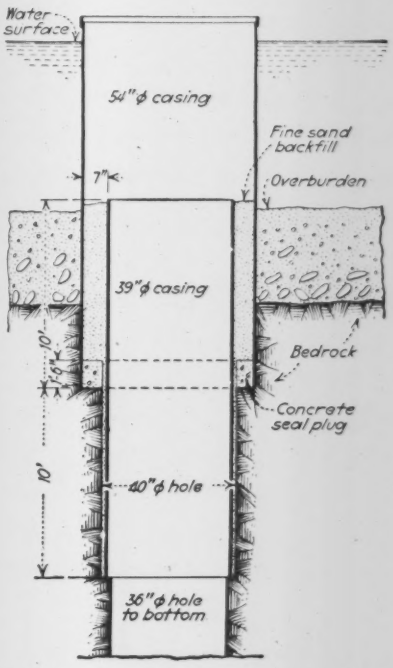

Fig. 3. Details of telescoping casings and cofferdam water seal that permitted calyx drilling in dry.

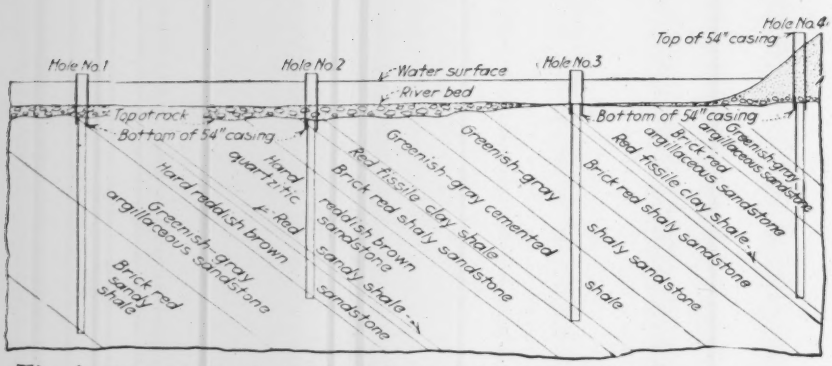

Fig. 4. Diagram of geological formation underlying part of the dam site as determined by visual examination of walls of deep dry holes.

outer cylinder was used as a common datum, and elevations of all geologic features were obtained by suspending a steel tape from this point. Dip and strike of strata were obtained by use of the Brunton transit. Adjacent holes were so spaced and drilled to such depths that the beds encountered near the top of one hole could be positively identified as those occurring near the bottom of the adjacent hole, thus enabling the geologist to construct an axial columnar section showing fairly accurately the location and extent of the underwater outcrop of each stratum encountered. Fig. 4 shows a generalized columnar section of a portion of the axis of the dam.

After final inspection of the hole had been made by the geologists and engineers, it was necessary to remove all casings above river bed that might obstruct navigation. These cylinders were removed by first jetting the sand from between the two cylinders, and then hoisting the inner casing to barge deck by the drill derrick. The concrete seal was broken out by a paving breaker. Four horizontal jackhammer holes about 18 in. long were drilled immediately beneath the bottom of the outer casing, and each hole was loaded with half a stick of dynamite. Explosion of the charge loosened the casing so it could also be removed by the drill derrick. The hole was left to be filled by river silting and can be reclaimed for further inspection or for use as a sump after the area has been unwatered by the construction cofferdam. The holes will be filled with concrete during the construction period.

A total of 712 ft. of shaft has been sunk at the Watts Bar site, of which 146 ft. was in the three river holes. In addition to the calyx drilling, a total of 240 ft. of 4-in. and 7,713 ft. of 2-in. diamond drilling was done. About 300 ft. of 22-in. casing was sunk through the overburden to obtain undisturbed samples of the top materials, and some 1,000 ft. of auger borings were made for sampling prospective borrow material for earth embankment sections.

Direction

The work was carried on under the direction of the Project Planning Division of the Tennessee Valley Authority, of which J. S. Bowman is head engineer and the author is field engineer in charge of the dam site drilling operations. The drilling was done by the Construction and Maintenance Division of the Authority, of which T. D. Lebby is superintendent and for which J. C. Blalock was foreman of drilling operations. Portland P. Fox was field geologist on the job, under direction of Edwin C. Eckel, chief geologist.

Rail Heads Cut in Repaving Job

In repaving Main St. of Portchester, N. Y., to eliminate abandoned trolley tracks from a busy through highway, the heads of the track rails were cut off with torches close to the level of the concrete base of the existing asphalt pavement, thus avoiding the expense of cutting through the base to take out the rails.

The existing concrete base had been laid between the ties of the trolley track. It is 8 in. thick and in sound condition. In the reconstruction work, involving 1.22 mi. of street, the upper part of the rails to a depth of about 3 in. was burned off leaving only the web showing through the base.

Five burners were used and the gas tanks were moved along on small metal-wheeled racks as the work advanced. Each burner could remove about 300 ft. of rail head in an 8-hour shift.

The new pavement top is an asphaltic mix, a 2-in. binder and 1-in. top. The total cost of the work is $40,927.

The work was done by the New York State Department of Public Works, of which Joseph A. Brady is county assistant engineer for southern Westchester county. A. Traub was engineer in charge of the work, and Francis I. McGrath is village engineer. Warren Brothers Roads Co., Cambridge, Mass., had the paving contract.

Trolley rails were eliminated from the surface of Portchester's streets by cutting off the rail heads before repaving.

Flood Compacts Defended at Engineers' Meeting

Discussion of flood-control before Connecticut Society followed by papers on early canals, state boundaries, sewage treatment and structural developments

OFFICIAL defense of the New England flood-control compacts led a strong program of papers at the annual meeting of the Connecticut Society of Civil Engineers, held at Hartford March 15 and 16. The compacts were discussed in three papers, by Gen. Sanford H. Wadhams, director of the State Water Commission, who reviewed and analyzed the development of the compacts and their relation to federal law and precedent; James H. Newlands, president of the Henry Souther Engineering Co., who considered the special incidence of power problems; and Judge E. J. Daly, who after demolishing FPC arguments against the compacts dealt with the questions of law involved.

The New England Compacts

Gen. Wadhams in his review of the compacts set forth in detail that they were framed in accordance with the provisions of the constitution and of the 1936 Flood-Control Act; that federal officials assisted in the work and approved their terms; that the Secretary of War publicly endorsed the resultant compacts and their preservation of state rights; that "far-fetched and untenable interpretations of the act of Congress" by the Federal Power Commission and the Attorney General caused the compacts to be pigeonholed in Congress. The reservation of states rights does not encroach on federal prerogatives and does not benefit private power companies but merely defines and limits the powers of the Interstate Flood Control Commission.

Turning to the federal attitudes, he said that the Federal Power Commission has declared itself opposed to the policy embodied in the 1936 Congressional act, and that one of its admitted reasons for opposing the compacts is that they would "preclude the adoption of the Norris plan of eight little TVA's." The President in a letter to Gov. Cross last August defined his attitude thus: "I cannot approve any compact which deals with the water resources of the nation or their development. It is my profound conviction that these matters are properly the subject of federal legislation and not of interstate compacts." However, Congress had specifically authorized such compacts, and various existing interstate compacts deal with water resources and their development.

At a conference arranged by the President on Jan. 19, 1938, said Gen. Wadhams, "the representatives of the Federal Power Commission vigorously maintained that the compact violates the power policy of the United States as established by the Federal Power Act; that flood-control dams, even though on non-navigable streams, automatically became 'government dams' if any federal funds were used in their construction, and therefore came under the authority of the Federal Power Commission, and that titles to such structures must rest with the federal government. As the state representatives were unable to compromise on these points the conference adjourned with no progress made . . . There seems little doubt that the people of the Connecticut River Valley do not want a TVA established here."

Surrender of state rights demanded

In closing he said, referring specifically to the Connecticut River compact, "It may appear therefore that it is the opinion of the Federal Power Commission that financial aid by the federal government in the construction of flood-control works is the price to be paid for the surrender by the New England states of the rights they now possess in these streams. However, the most careful reading of the Flood Control Act fails to reveal that the Congress in writing the act intended to convey any such far-fetched implication. In the meantime the compact is temporarily buried. The chance of resurrecting it appears to rest on the possibility of convincing Washington of the reasonableness of the position taken by the New England states."

Mr. Newlands, after analyzing various alleged and actual power implications of the situation, stated that "We in Connecticut are not interested in power. We want flood control, but because a few men insist that flood control shall not be granted unless the northern states give up their rights to power and water conservation values on small streams now admittedly under state control, the lives and property of New England citizens continue in jeopardy."

Judge Daly considered and answered the Federal Power Commission arguments against the compacts and then challenged the op-

BOUNDARY STONE at Warwick Corner, a strategic point on the Connecticut-Rhode Island line, was set in 1740 and still marks the corner.

ponents by saying, "Our compact is now before Congress, approved of by committees of both branches. Is this situation to go on indefinitely, with new acts and resolutions being introduced in Congress and nothing being done? If those who oppose the compacts do not provide some other means of flood control the responsibility for the consequences is theirs and theirs alone."

Canal building in Connecticut

During the canal-building days of a century ago two canals were built in Connecticut and three others were projected. Charles Rufus Harte, engineer, Connecticut Co., New Haven, in reporting his researches into the history of these canals, dealt particularly with the Farmington or Hampshire-Hampden Canal and the Enfield Canal at the rapids of the Connecticut River.

The Farmington Canal was built from New Haven north to the Massachusetts line in the 20s and 30s of the last century; its projected continuation to Northampton, up the Connecticut River, and from northern Vermont by canal, lake and river to the St. Lawrence, was never undertaken. It had a fair volume of business, but high cost of maintenance made it unprofitable, and in the latter 40s it was replaced by a railroad laid on the towpath. Parts of the canal may still be seen.

Canals were projected in the Quinebaug Valley, up the Housatonic, and up the Saugatuck and Still River valleys from Westport to New Milford, but they did not progress to the stage of construction. A factor in the state's canal history was that a strict system of public-utility regulation had been established in the 1790s, to control private turnpikes, and this system was applied to the canal projects. Under such regulation the financing, design and construction were rigidly controlled by state boards.

Defining the state boundaries

H. W. Buck, consulting engineer, Hartford, gave a highly interesting account of how the state lines of Connecticut were fixed. Conflict of Colonial grants, lack of definiteness in the terms of those grants, and survey inaccuracies led to controversies that continued for two centuries. The "Colony Line" between Massachusetts and Connecticut, first marked out in 1713 to 1717, ultimately became the basis for the adopted northerly boundary (1826). The largest departure from the line is the narrow projection of Massachusetts territory below the line in the southern part of Westfield.

An odd exchange of territory determined the irregular western boundary line. Overlapping charters granted by the King of England to Connecticut (1662) and to the Duke of York (1664), and the existence of Connecticut settlements on the north shore of the Sound west to Mamaroneck and on the easterly half of Long Island led to a compromise in 1683 by which Connecticut relinquished its Long Island claims and New York limited its mainland claims to twenty miles east of the Hudson. Connecticut's Sound shore jurisdiction was recognized to Byram River for a depth of eight miles inland, but the area of 61,000 acres thus taken from New York was made up by an eastward shift of the line extending northward to the Massachusetts corner. Survey difficulties in carrying out this compromise were not settled until 1860, however.

Charter conflicts also led to long disputes over the Rhode Island line, but the final line was agreed upon and marked on the ground about 1730. It was better monumented in 1740 to 1742. One of the bounds then set still exists (Warwick Corner), though later reset in concrete (1923). All three boundary lines have since been tied into geodetic control and are perambulated every few years to determine the condition of the monuments.

Structural developments

Prof. Hardy Cross, of Yale University, New Haven, in a paper on structural developments, said that "timber trusses of 200-ft. span are more news today than they would have been in 1850; continuous bridge trusses are less news today than when the St. Lawrence was crossed at Lachine Rapids." One recognized major development of recent years is the evolution of use of continuous structures, which he attributed among other things to experience with concrete. Highway bridge departments, "formerly cathedrals of conservatism," have done much in applying continuous construction. Slab, shell and frame constructions, high-strength concrete, and welding, are other important recent developments.

Discussing engineering registration, Prof. Charles F. Scott, chairman of the state board of registration, remarked that determination of the qualifications of applicants is not subject to precise rules, especially in the matter of evaluating experience. Registration was not required in Connecticut until two or three years ago; up to now about 1,500 engineers and surveyors are registered. Enforcement activities have not been necessary so far, and in Prof. Scott's opinion are mainly the responsibility of engineering groups. Registration boards, he said, are engaged not in applying rules but in pioneering the development of principles out of the hodge-podge that arises from the range of engineering practice and the wide variety of types of training.

Hartford sewage-treatment plant

An interceptor and sewage-treatment project under construction at Hartford since 1935, serves the metropolitan district and the city of West Hartford, a present population of something over 200,000. As described by W. A. D. Wurts, sanitary engineer of the Metropolitan District Commission, the treatment plant comprises coarse screens with hammermills that pulp the screenings for return to the sewage; grit chambers with conveyor discharge to dump cars; eight settling basins with air agitators and sludge scraper and skimmer equipment; four heated and insulated concrete digestor tanks; vacuum dryers, and an excess gas burner. Control equipment is unusually complete. The plant will cease operation in flood time, the sewage then being passed direct to the Connecticut River. Grit and dried sludge are to be dumped near the plant. The layout provides for expansion and for addition of secondary treatment. In its present arrangement and capacity it is expected to be adequate for twenty years.

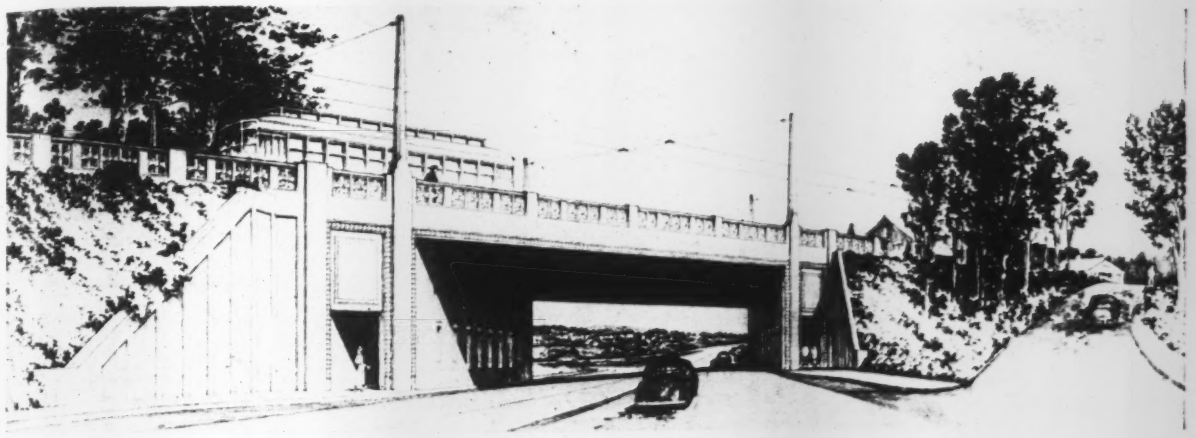

FIG. 1. ARTIST'S DRAWING USED WHEN AN EAST PORTLAND UNDERPASS WAS PROPOSED

Picturing Plans for the Layman

Artists' sketches are used to aid visualization of proposed improvements when public hearings are held by the Oregon Highway Commission

BLUEPRINTS mean so little to the average man that engineers' drawings of proposed improvements are quite unsatisfactory for conveying a clear picture to the lay mind. When a public hearing is held and effective discussion of proposed work depends upon having citizens *en masse* understand just what it is proposed to do and what the finished structure will look like, the engineer's plan, profile and section fall far short of meeting the requirements of the occasion. The engineer himself is so familiar with the conventional type of engineering drawings and to him they bring information in such full detail that he is likely (1) to overlook the inadequacy of the picture blueprints convey to a public assembly, or (2) to despair of presenting the full detailed picture to those who cannot read the working drawings.

The Oregon State Highway Commission has recognized the necessity of informing the public as to just what is contemplated in a proposed improvement and has found a successful means of doing so. When a public hearing is to be held by this commission the engineers' designs are not used to explain what is proposed, but instead artists' sketches showing the proposed structure or improvement from different angles are displayed on walls or tables. Not only have the artists' sketches, developed under the direction of R. H. Baldock, Chief Engineer, Oregon State Highway Commission, and reproduced on this page, been a most satisfactory means of conveying in universal language a clear idea of just what is proposed, but often the pictures which show the landscaping and the finished appearance (usually not apparent from the blueprints) have aided in dispelling objections and forestalling protests that otherwise might have arisen.

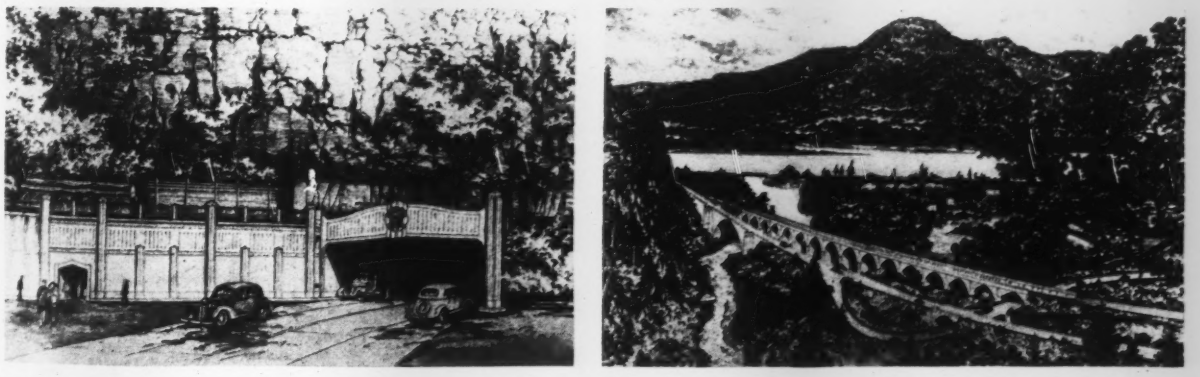

Fig. 2. **The Oregon State Highway Commission used these illustrations to convey to voters conceptions of proposed jobs—(left) an Oregon City undercrossing—(right) Tanner Creek span and entrance to Bonneville on Columbia River.**

Roadways on Bridges—II

by E. Warren Bowden
Assistant to Chief Engineer, The Port of New York Authority, New York

Further ten-year bridge roadway design trends are presented in this second article on practices of two authorities at New York

Last week Engineering News-Record *published the first part of this article on two New York authorities' ten-year bridge roadway development. This second and concluding part deals with anchorage of concrete slabs to floor steel, expansion joints, drainage provisions and operation and maintenance. Two illustrations pertaining to this section were published last week. One shows progressive development of details for anchoring slabs to steel supports, and the other shows expansion joint details used at the towers of Triborough and George Washington Bridges.* — Editor.

Anchorage of the concrete slab (other than the type using bulb beams) to the floor steel is one of the interesting features which has been progressively developed in the course of the designs. The idea of the formation of a statical unit by causing the steel and concrete to work together is not by any means exclusive with the work of the Port Authority engineers; however, it was independently developed on the structures herein described. Recently, other similar designs have been reported, one of the most notable, a Swiss development, makes use of a spiral rod welded to the top flange of the steel beams on which the floor slab is cast.

On the first two bridges built by the Authority, the Outerbridge Crossing and the Goethals Bridge, no positive means of anchoring the concrete slab to the floor steel was provided, although the bottom of the slab was made flush with the underside of the top flange of the floorbeams, thus keying the slab to the beams. The first slab anchors were provided on the approaches of the Bayonne Bridge and were $\frac{7}{8}$-in. diameter bolts spaced at 3-ft. intervals along the top flanges of the stringers supporting the slab. The bolts were attached to the flanges by double nuts and were hooked at the ends to provide positive anchorage.

Engineers of the Port Authority first attempted to secure the advantages of structural unity between the slab and the steel in designing the New York approach of the George Washington Bridge in 1930. On that work four bulb angles 4x3½x⅜ in. and 8 in. long, were riveted to the top flange of each roadway stringer. These angles developed shear between the slab and the stringer, thus securing greater rigidity of the floor, deflections being reduced because of the participation of the floor slab concrete in the stress action. However, no attempt was made to reduce the sections of the steel members on account of the advantage thus secured because rigidity rather than a structural saving was being sought in this case.

The same general type of anchorage was used on the Triborough Bridge where 3-in. *Z* bars in 3-in. lengths were welded to the stringers at 6 ft. spacing.

The general scheme has been developed still further for floor slabs on structures now being built. Double angles placed back to back are riveted to a third upstanding angle which gives the positive anchorage in the slab. The double angles are very stiff against bending and by means of four rivets through the stringer flange are able to develop the shear fully. These anchors are spaced relatively close together near the ends of the stringers. Extra rods in the slab and additional shear plates create an unusually rigid floor structure.

On the Bronx-Whitestone Bridge anchorage of the slab is accomplished by welding each embedded I-section to the crossbeam at alternate points of support.

Expansion joints

Various types of expansion and construction joints are found on the bridges described, the design depending on the amount of movement for which provision is required. At the expansion joints on the Outerbridge Crossing and the Goethals Bridge, the ends of adjacent concrete slabs are finished in plate and angle construction, and a normal opening between slabs of 4 in. is bridged by a checkered steel plate. On the approaches the main expansion joints are spaced at roughly 400-ft. intervals, while on the truss spans the expansion joint locations are determined by the structure, i. e. at the ends of the anchor arms and at the ends of the suspended spans, making the intervals between expansion joints range from 300 ft. to 600 ft.

Transverse construction joints are located at less than 40 ft. intervals, at every intermediate floorbeam on the truss spans and at about the same intervals on the approaches. At intermediate floorbeams the lower halves of adjacent slabs butt together while a ½-in. opening is left in the upper half of the slab and filled with asphalt. At end floorbeams the adjacent slab sections are finished to have an opening between of ½ in. A 16-oz. copper strip spans this opening and embeds in both slabs at about half the slab depth and thus retains an asphaltic joint filler.

A sliding plate expansion joint was used on the approaches of the Bayonne Bridge, while on the arch span the principal roadway expansion is provided at three joints spaced at about 165-ft. intervals, or at every fourth panel point, near

each end of the arch. At these points grating types of joint are used. Intermediate joints, similar to those used on the George Washington Bridge, described below, are spaced at every fourth panel over the midspan section. The main floorbeam at each panel point on the arch span is flanked on either side by a pair of secondary floorbeams which carry the slab. All expansion joints are located over one of this pair of beams, while over the other beam the slab is given a groove which is filled with mastic. The result is a transverse strip of slab 4 ft. 11 in. wide at each panel point. At panel points where no expansion joints are located, two grooves are used.

The entire movement of the roadways on the suspended spans of the George Washington Bridge, the Triborough Bridge and the Bronx-Whitestone Bridge is taken care of at the towers, the roadway surface being carried past these points on gratings. Since the general principle is the same in all cases only the arrangement at the Triborough Bridge is described here.

The gratings consist of bars 4½ in. deep and ⅝ in. wide which interlace with similar bars from the adjoining span. In forming the grating, the bars are separated by 1⅛-in. spacers so that the interlacing bars have ¼ in. total clearance. This is a very important consideration since on the George Washington Bridge, where the clearance is only ⅛ in., the close spacing promotes the formation of ice between the surfaces of the grating bars even at times when the surrounding air temperature is slightly above freezing. A binding action is thus caused between the interlacing gratings. New gratings with wider spacing will be installed to replace the original gratings in the near future.

The detailed arrangement of the roadway expansion system at one of the towers of the East River Crossing of the Triborough Bridge was shown last week. It will be noted that the free ends of the grating bars bear on a plate with a curved surface, attached to the upper flange of a beam on the centerline of the tower. Bolts held under constant tension by springs are used to hold the grating down firmly while leaving it free to adjust itself to the movements of the spans at its point of bearing on a 2½-in. x 1¼-in. half-round bar. A somewhat different detail without the spring arrangement was used at the George Washington Bridge. It will be observed that the end of the concrete slab at this expansion point is thickened in order that embedded rods may be used in addition to embedded straps to insure firm attachment between the end of the slab and the steel.

Intermediate stress expansion joints are provided at alternate panel points, or at 57 ft. 9½ in. spaces, throughout the length of the suspended spans. The design at these joints was shown in last week's sketches of the anchorage details (Fig. 5). It will be noted that the end of the left-hand slab is fixed while the adjacent slab is free to move with the distortion of the roadway system. The reinforcing trusses bear on a 2½x¾-in. continuous steel plate which slides on the top flange of the cross beam. This plate is fillet welded to both sides of every fourth truss. Uplift of the slab is avoided by means of an 8x⅝-in. continuous steel plate which engages the top flange of the cross beam and is connected to the slab by means of embedded hook bolts. A bent metal strip, inserted between the filler plate and the top flange of the cross beam, prevents the entrance of concrete at this point during the pouring of the slab. A ¾-in. premolded joint filler extends within 2 in. of the top of the slab; the remainder is a poured bituminous filler.

The same general type of intermediate expansion joint is used at each panel point on the George Washington Bridge. Panel lengths are 60 ft. and the slabs have expansion joints ¾ in. wide over the secondary floorbeam on the expansion side of each main floorbeam. The slab on one side of this joint is rigidly connected to the beam by the rivets through the bulb beams. The other slab is free to slide on the beam and is held down by "T" clips, which are fastened to the underside of every other bulb beam and project under the top flange of the floorbeam. A premolded asphalt filler is used in the lower 6½ in. of the joint while the upper 2 in. is filled with tar.

A detail with regard to this design should be noted at this point, namely the fact that the "T" clips, which are intended to allow motion in the expansion end of the slab over the stringer, are not adequate to hold the slab in contact with the floorbeam if, due to the general deformation of the structure, the floor slab tends to rise at its point of sliding support. This lifting of the end of the slab from its end floor beam has been found to occur only in the side spans. However, unless the condition is corrected, a pounding action takes place with the passage of every vehicle. To overcome this pounding it has been necessary to insert metal shims ranging up to ¼ in. in thickness. Wherever longitudinal construction joints are used on the roadways described, the practice is to tool the edges of adjacent slabs at the roadway surface to a smooth finish, providing a V-shaped groove which is filled with bituminous mastic.

Drainage provisions

Transverse drainage is provided on the Port Authority structures by a slope of ⅛ in. per ft. On the Triborough Bridge the normal transverse slope is 1/10 in. per ft.

For drainage purposes on the suspended spans of the George Washington Bridge 14x14½-in. cast steel scuppers with 4-in. chrome-nickel downspouts, long enough to extend below the floor steel, are located at about 30-ft. intervals along each outside gutter. The downspouts discharge directly into the open. However, at points adjacent to the anchorages and over Riverside Drive, drainage inlets are spaced much farther apart, at roughly 150 ft. intervals, and reinforced concrete inlet boxes, 4 ft. 3 in. deep, 4 ft. long and 1 ft. 10 in. wide are provided. From these, 10-in. drainage pipes lead to the general storm system.

On the Triborough Bridge a similar arrangement of scuppers and downspouts was provided on the suspended spans and permitted to discharge directly into the open. However on the viaduct structure, scuppers were spaced along each outside curb at varying intervals, which average about 33 ft. except on the curved section of the viaduct on Ward's Island where, due to the super-elevation, it was necessary to locate one set of scuppers along the center barricade. From the scuppers, 4-in. pipe connections are provided to a drainage system leading to the

piers, through which the pipes pass to connect with a general storm system. A clean-out plug is provided at a "Y" connection in the pipe below each scupper. However, because of the relative inaccessibility of these clean-outs, it has been found that maintenance of this system is very difficult and expensive. The accumulation of debris, especially during the winter time when anti-skid materials are used on the deck, has been such as to completely close the drains in many cases.

Drainage gutter

A special drainage gutter was installed under the main expansion joint at each tower of the Triborough Bridge. The gutter, of $\frac{3}{8}$-in. plate, is framed between the tower stringers and drains to a point near one side of the deck where the water is discharged into a 6-in. pipe. No special drainage provision was attempted under the gratings at the George Washington Bridge towers. However, copper gutters were placed under joints at the anchorage ends of the side spans.

Granite curbs, $13\frac{3}{4}$ in. high, were used on the Outerbridge Crossing and the Goethals Bridge. On the Bayonne and George Washington Bridges the curbs are of plate-and-angle construction, topped by a steel barricade. The curb is 10 in. high and 12 in. wide; the barricade 18 in. above the curb. Both barricades of the Bayonne Bridge and the inside barricades on the George Washington Bridge are surmounted by 2-ft. hand railings. The outside barricades at the latter bridge have no top railing but are close to the inner railings of the sidewalks which serve as additional barriers.

Triborough curb design

The Triborough Bridge curb design is an interesting departure from the more conventional type. Actually there is no curb at all, the outer 18 in. of the roadway slab adjacent to the barricade being sloped upward at the rate of 1 in. in 3 in. It is intended that this slope shall permit the utiliaztion of the full width of the roadway between side barricades while at the same time providing a warning in case of the too close approach of the vehicle to the barricade. In the opinion of the writer this sloping curb is of little value in operation because its slope is too gentle to give adequate warning to the driver in case of encroachment upon it, with the result that drivers apparently place little dependence on it but tend to keep at a safe distance from the barricade. The outside barricade of structural steel extends 3 ft. 4 in. above the deck and is 12 in. wide. The center barricade, or traffic island, has a height of 2 ft. and is 3 ft. $8\frac{1}{2}$ in. wide.

The new Bronx-Whitestone bridge will make use of inclined steel curbs. The inclination from the vertical is 6 in. per ft. of height. The center barrier between roadways will be 1 ft. 6 in. high and the outside barricade between the roadway and the footwalk is to be 2 ft. 6 in. high.

It is to be noted that on the later Port Authority bridges, namely, the George Washington Bridge and the Bayonne Bridge, and on the Triborough Bridge and the Bronx-Whitestone Bridge, an adequate safety barrier is placed between the sidewalk and the roadway.

Experience under operating conditions

At appropriate points in this article, the writer has commented on the operating experiences with the several types of roadway design. In general, it should be said that the roadway surfaces thus far have proved very satisfactory under operating conditions, having demonstrated adequate anti-skidding qualities combined with a smooth riding surface and other desirable roadway features.

Recently a careful survey was made of the pavement on the George Washington Bridge which has been in use over five years and has carried approximately 30,000,000 vehicles. In general, the roadway was found to be in excellent condition with the wear evenly distributed and evident only to the extent that the original brooming has been worn off in the traffic lanes to show the aggregate in the surface. No scaling or spalling has taken place except in the case of a half-dozen slab sections on the New Jersey approach between the toll booths and the bridge proper where the concrete rests directly on the subgrade. At these slabs the condition is by no means serious and would not be observed by the occupants of a vehicle passing over the roadway. Apparently, it is due to defects in finishing the particular sections which show this defect.

The fact that this condition is confined to the south half of the roadway adjacent to the toll booths, where vehicles are obliged to pass immediately after leaving the toll area, has suggested to some that it may be due to the calcium chloride used to prevent the formation of ice at the booths. However, this theory seems to be refuted by the fact that the concrete surface west of the toll booths, over which the west-bound vehicles pass and to which presumably they would tend to carry the calcium chloride in exactly the same manner, is in perfect condition and shows no sign whatever of scaling. In the case of the slabs where scaling occurs, it is more pronounced in the center of the section and has no relation to the wheel tracks. Also, a space of several perfect slabs separates the defective surface near the toll booths from another section where this condition is evident farther along the same traffic lane.

The only evidences of surface defects in the slab on the suspended floor structure are superficial cracks which are found in a small percentage of the sections. They can be seen only upon close inspection and, for the most part, are so small as to be visible only when the slab is drying out after a rain. These cracks follow a general pattern and run longitudinally in the deck, apparently occurring directly over the bulb beams which form the principal slab reinforcement. They are very minute and have caused no spalling or other deterioration in the surface. This same condition is found at the Bayonne Bridge and probably is due to the fact that the solid webs of the bulb beams separate the concrete into blocks which are interconnected only by means of the relatively thin concrete ($2\frac{1}{2}$ in. in depth) above the bulbs. It is not found where expanded metal or other reinforcing trusses are used.

None of the sections has spalled or chipped at the secondary expansion joints, and care is exercised by the maintenance organization to keep these joints well filled with bituminous material.

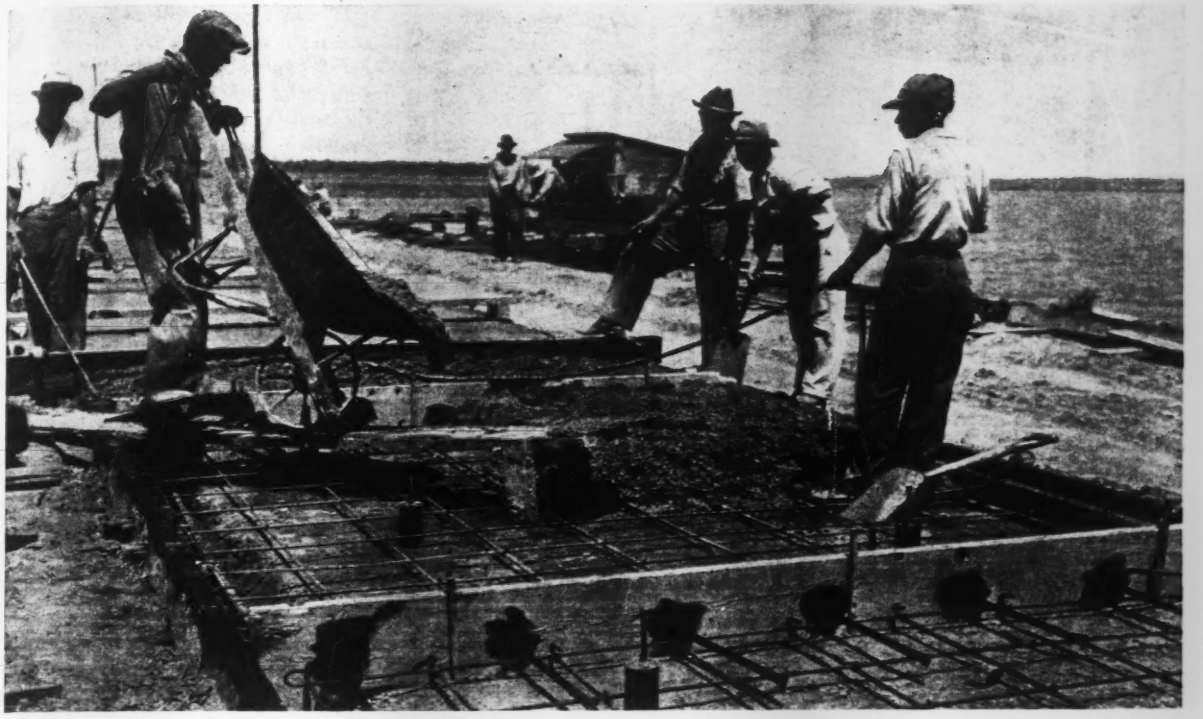

FIG. 1. PAVEMENT BUILT IN SLABS, ONE LANE AT A TIME, SO THAT HALF OF CAUSEWAY WAS OPEN TO TRAVEL

Pavement Designed for Releveling

by W. E. BARKER

Regional Highway Engineer, Portland Cement Association, Chicago, Ill.

A settling marsh fill in Mississippi has a concrete pavement designed to be releveled as the fill sinks

A PAVEMENT designed to anticipate subgrade settlement is not unusual; such pavements have however been designed to subside with the subgrade and be replaced when settlement has ceased. In the work described here an entirely different thought is had: Build a permanent pavement at once but so devise it that it can be kept to true grade as the subgrade settles. This is a new thought and it comes from Mississippi which is now doing a major job of modern roadbuilding as was outlined in *Engineering News-Record*, March 4, 1937.

Just west of Pascagoula, the Old Spanish Trail (now U. S. 90) crosses a tidewater marsh that borders Pascagoula River. Through this marsh the road is carried on a causeway of filled-in land held between two bulkheads that are tied together by iron rods.

The old road, built many years ago, was barely wide enough for two-lane traffic. Last year new bulkheads were built outside the old, widening the fill, and this year a 20-ft. concrete pavement was laid by Jackson County, which operates the toll bridge over Pascagoula River. To guard against damage from settlement the concrete pavement was built in blocks 10 ft. wide by 12 ft. long (Fig. 2) specially reinforced, and provided with built-in mud-jack holes.

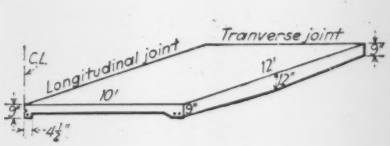

Fig. 2. Slab thickened along the centerline and at the edges to provide strength in case of subgrade settlement.

When the original bulkhead was built, rows of piles were driven across the roadway at 12-ft. intervals to support the piledriver while it placed the bulkhead walls. These piles are about 3 ft. below the present roadway surface, and it seemed possible that the subgrade over them might support the slab more firmly than the intervening fill and so transverse joints were located over each row, making the slabs 12 ft. long. Also the slabs were heavily reinforced with bar mats placed 2 in. from the bottom. As shown, the outer edges of the pavement were designed as beams so that the edge of the slab

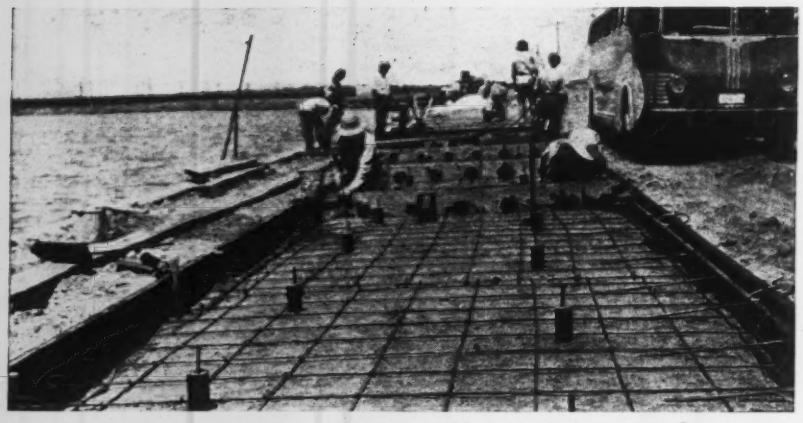

Fig. 3. Ready to concrete with forms set for mud-jack holes.

is 9 in. thick at transverse joints and increases to 12 in. midway between joints. Each edge along the center joint was thickened to 9 in. Two bars were put at the bottom of the outer edges and one in each of the beams along the center joint. In addition metal cans of the correct height and diameter were set on the subgrade to mold mud-jack holes. They were filled with sand, to keep the concrete out, and each was held in position with a pin like that used in fastening deformed metal plate in place on the centerline. If any settlement occurs the slab can be lifted back into position with a mud-jack, at very little cost, as the cost of drilling the holes is ordinarily a large part of the cost of mud-jacking.

It was imperative that traffic be maintained during construction, as there was no available detour. The pavement was, therefore, built half-at-a-time and one-way traffic was handled by two flagmen. A deformed metal plate was laid along the form, at the centerline, and ½-in. tie bars, 4 ft. long, were bent at right angles so that one half of the bar could lie behind the *V* of the deformed plate while the other half projected into the first-laid concrete. When the second half of the slab was built these tie bars were straightened, so that the free half would be embedded in the second-laid half of the slab. All transverse joints contained expansion material and were bridged by ¾-in. round smooth dowel bars spaced 17 in. apart, painted to assure slippage in the concrete and capped on one end to provide a space into which the end of the bar can push as the joint closes.

Day-labor force

The work was done entirely by the county, on a day-labor basis, under the direction of L. C. Winterton, Consulting Engineer, Pascagoula, Miss. The concrete was mixed in a small stationary mixer and carried into place on the subgrade in wheelbarrows. The proportions were carefully worked out and batches of both sand and gravel were weighed on small platform scales. High-early-strength cement was used to assure early opening.

Effect of Garbage on Sewage Treatment

TENTATIVE CONCLUSIONS regarding the effect of garbage on sewage treatment processes were reported by Dr. Willem Rudolfs of the New Jersey Agricultural Experiment Station at the recent meeting of the New Jersey Sewage Works Association. Based on laboratory investigations of settleability, on the effect of garbage on chlorination and chemical coagulation, the dewatering of sludge, and the oxidation of sewage-garbage liquors, the findings were:

(1) Addition of ground garbage to sewage causes little change in the volume of sewage, but doubles, at least, the total suspended solids content.

(2) Material from the garbage settles more rapidly than normal sewage particles, and deposits of organic matter are increased in grit chambers where these are used.

(3) There is an increase in the biochemical oxygen demand (B.O.D.) of the settling tank effluent of garbage-sewage mixtures.

(4) Sludge volume in settling tanks is increased because of the garbage additions.

(5) Mixtures of garbage and sewage behave similarly toward chemical coagulants in the removal of turbidity as does sewage alone.

(6) Presettling is of little value for mixtures of garbage and sewage even though they are made from "strong" sewages.

(7) The B.O.D. of the mixture effluent is markedly increased over that of sewage alone.

(8) A mixture of garbage and sewage has an increased iron demand but may or may not have an increased aluminum demand.

(9) The cost of treating mixtures chemically when pH adjustment is used, is in general slightly greater than that for the chemical treatment of sewage alone.

(10) Effluents from settling tanks receiving sewage and garbage can be readily stabilized by treatment with activated sludge.

(11) The rate of oxidation of a mixture of garbage and sewage effluent is higher than that of sewage effluent alone.

(12) Undigested sludge containing garbage can be dewatered as readily as sludge without garbage, but there will be more sludge.

(13) The addition of ground garbage liquor to undigested sludge produces a sludge mixture which is difficult to dewater or digest.

(14) When ground garbage has been added to sewage the sludge from the mixture will digest readily.

(15) Ripe sludge from the digestion of solids containing garbage will dewater at least as readily as ripe sludge from sewage solids.

(16) The chlorine demand of garbage-sewage mixtures is somewhat greater than that exerted by sewage alone.

(17) The chlorine demand of a garbage-sewage mixture effluent from a chemical precipitation plant is only slightly increased.

A Water Policy Evolves

National Resources Committee presents a revised 6-year plan for water use and control

THE Water Resources Committee of the National Resources Committee was organized in June, 1935, as the successor to a series of committees which had been studying the water problems of the country ever since PWA first faced the problem of developing an emergency public works program which could fit into a broad plan to develop the resources of the country. In December, 1936, the committee submitted its first report on drainage basin problems and programs, which summarized its ideas on the planning of water programs and presented a six-year plan of public works. Last summer the resident requested the committee to revise its report in such a way as to present "a comprehensive national plan for flood control and prevention andt he development of water and soil conservation." The 1937 revision of the drainage basin report was transmitted to Congress by the President early this month.

The procedure used in drawing up this report seems to indicate that the principles and program presented represent a synthesis of the present views of the administrative agencies of federal and local government. All but three members of the Water Resources Committee itself are connected with the federal administration, and of these three, two are state officials. The detailed study of the project was made by 45 drainage basin committees, each made up of state and local representatives designated by the governor or chairman of thes tate planning board and of field representatives appointed by the federal agencies chiefly concerned.

In preparing its program, the committee has been guided by two general principles: that water projects should be carried out in accordance with a broad plan taking account of all the interlocking uses and dangers of water, and that such a plan must be prepared on a regional basis, studied primarily in terms of individual drainage basins.

A sound water policy, the committee holds, will treat the control of water not as a purely engineering problem but rather as a problem in the general public welfare. It will treat drainage areas as units, and will seek to promote the maximum control and use of water technically and socially possible at any time. Such a policy will observe the rights of the states and will assign costs in accordance with the benefits.

In addition, a sound program should be so drawn up that the tempo of development can be varied to suit the fluctuations of the business cycle.

The interstate compact is recognized as an important agency in carrying out such a program. At the same time the committee emphasizes the importance of preserving the rights of the federal government in drawing up compacts, since once approved these treaties are nearly impossible to eliminate.

At the same time that it has formulated the principles which it conceives must guide a long-range plan, the committee recognizes that the present is a period of transition and that the mechanism, and in many cases the knowledge, for preparing and carrying out such a program is not now in existence. Hence, the committee has prepared its immediate program in such form as to take account of the fact that the varied uses and dangers of water are dealt with by different agencies.

Flood control

The Omnibus Flood Control Act of 1936 for the first time established a definite flood control policy providing for participation by the federal government in construction of economically justified projects throughout the country. Previously, except in the Mississippi Valley, federal flood control work had been restricted to particular projects.

Of outstanding interest is the first progress report of the sub-committee on the Ohio-Lower Mississippi River regulation program.

The sub-committee points out that there is now no suitable plan for the protection of the Ohio and Lower Mississippi River valley against floods of maximum height. Even the knowledge on which such a plan could be based is lacking and cannot be obtained for several years. To embark at once on a large program of construction, it is held, would be illogical and wasteful.

Detention reservoirs in the tributary streams are not felt by the sub-committee to have much value as regards protection of the main valley against major floods. These have a definite value for conservation of water, reduction of frequency and height of minor floods on the main rivers, and for control of floods in tributary valleys. The popular belief that reservoir systems on the upper tributaries would prevent major floods may, if not corrected, "commit the country to a mistaken policy that might have tragic consequences."

In a different category is the question of large reservoirs on the lower Tennessee and Cumberland, on the main stem of the Ohio near its mouth, on the Arkansas and Red at sites near the Mississippi, and on the Mississippi itself between Cairo and the mouth of the Kaskaskia. Full and unbiased investigation of the possibilities of such reservoirs is strongly recommended. It is pointed out, for example, that a combination of large dams at Gilbertsville on the Tennessee, Dog Island on the Ohio, and Commerce on the Mississippi might do away with the necessity of any more levee and floodway work on the Mississippi from Cairo to the mouth of the Arkansas. A large dam in the Arkansas near Little Rock might have a similar effect on the lower Mississippi. The Gilbertsville reservoir alone would have reduced the crest stages at Cairo in 1937 by about 2 ft. The sub-committee presents a list of more than twenty reservoirs with capacities greater than 1,000,000 acre-ft. each for study and recommends a priority list of nine reservoirs, investigation of which should be undertaken immediately.

Also recommended is zoning of the flood plain area. For many communities, it is pointed out, the cost of relocation would be far less than

the expense of protection would be.

An important field for zoning is to be found in the large areas normally subjected to backwater from the lower Mississippi at high stages. These areas function as natural retarding basins and they should generally be zoned for national forests, wild life preserves, etc.

The committee concludes that until further studies are made, it would be "most unwise for the Congress to authorize at this time any general flood control plan."

The committee recommends maintenance of the principle of local responsibility in the cost of flood control and protection. Existing policy, however, should be modified to provide for allocation of cost substantially in proportion to the incidence of benefits. This is stated to be difficult but not impossible.

Inland waterways

Radical changes are recommended in the procedure for the development of inland waterways which has been current in the past. It is pointed out that many waterways now developed are not used sufficiently to justify the great expenditures which were made.

It must be borne in mind, moreover, that the transportation situation in this country has changed greatly in recent years. A well developed transportation system by rail, highway, and waterway has grown up, and it appears that the aggregate demand for transportation will not increase in the future as rapidly as was formerly anticipated.

Selection of navigation projects, it is asserted, should be made by a planning unit free from administrative responsibilities connected with construction or operation of projects. This unit can recommend "integrated programs of river regulation and river development in *all* their phases."

Perhaps the most radical departure in the committee's recommendations is the suggestion that the government consider charging tolls for the use of improved waterways.

Hydro-electric power

From a depression low of 83 billion kw.-hr., annual power consumption in the United States rose during 1937 to a new high of 119 billion kw.-hr. This rise has severely taxed available production facilities and it is therefore important, in the commission's view that plans for regulation and development of rivers involve consideration of potential power resources wherever they exist. As far as the federal government is concerned, the major interest is in multi-purpose projects. In fact, the committee interprets the Federal Power Act of 1935 to mean that where possibilities of multi-purpose development exist, single-purpose development should not be allowed, which would seem to mean that the development would have to be governmental.

Multi-purpose projects always raise the question of the proper power charge. On this point the report holds that allocation of cost should be made with proper regard to the values of the several types of benefits afforded, and the revenue from the sale of power should be based upon the cost allocated to power. It is held, however, that allocation of joint costs "is usually a matter of judgment involving an appraisal of social and economic values and not ordinarily a matter determinable by any definite accounting formula."

Irrigation

There are 700,000,000 acres in the United States in which agriculture cannot safely be carried beyond the rudimentary stages without irrigation. We have now reached the point at which most of the small and relatively inexpensive irrigation projects have been carried out, and it therefore becomes important that more comprehensive investigation of the water resources of the arid and semi-arid states be carried on to provide an inventory of possible reclamation developments.

The present basis of payment for reclamation work is held not to be satisfactory. In the future, all economic and social benefits arising as the result of an irrigation project should be evaluated and water users should be charged only with costs specifically chargeable to irrigation.

It has been found that the Reclamation Fund, set up in the reclamation act of 1902, is not circulating as rapidly as had been expected, especially since the repayment period has been extended from its original ten years to about forty years. In addition, the sale of public lands, formerly a principal source of revenue for the reclamation fund, has now practically halted. Therefore, the reclamation fund, if retained, should be supplemented adequately from other sources.

Water supply and pollution

The more pressing problems of water supply and stream pollution abatement, the committee points out, are not nation-wide but arise primarily in certain highly urbanized and industrialized areas—chiefly in the Northeast, the Ohio River basin, the upper Mississippi basin, sections of the Great Lakes region, and small areas along the Pacific Coast. These problems also differ from those previously considered in that in general the basic facts for their solution are already available.

The committee holds that a national policy for pollution abatement must take into account the fact that the power to control pollution rests in the police power of the several states and that the responsibility for pollution abatement should rest primarily on those causing pollution.

Federal participation in pollution abatement activities, it is recommended, should be limited to loans and grants for the encouragement of pollution abatement; the encouragement of interstate compacts, and of uniform laws and practices; research on methods of treatment and disposal and participation in the establishment of suitable standards of water purity, as well as surveys of pollution situations in entire drainage areas. At the same time, activities of state and local agencies should be co-ordinated, with federal assistance, and the entire pollution abatement program should be co-ordinated with the broad water program.

The drainage of swamp land, again, is felt to be almost exclusively a local problem. At the same time the committee feels that land drainage programs have often been undertaken injudiciously and that, by encroachment on the flood plain, these projects have occasionally interfered with flood control programs. The present land requirements for agriculture, moreover, raise considerable doubt as to the desirability of bringing more land under cultivation by drainage.

THE WEEK'S EVENTS

(Continued from page 423)

Commission Denies Help To Reclamation Projects

Supplementing its action postponing 1937 reclamation payments by seven projects (*ENR*, March 10, 1938, p. 355) the repayment commission appointed last November by Sec. Ickes has announced five additional decisions, of which three are denials of relief from payments now due.

Yakima project, Wash.—The request of the Tieton Water Users' Association that a portion of the 1937 construction charges be postponed is denied.

Garland division, Shoshone project, Wyo.—Application for extension denied.

West Extension and Hermiston irrigation districts, Umatilla project, Ore.—Entire 1937 payment postponed and added to remaining construction indebtedness.

Malta and Glasgow divisions, Milk River project, Mont.—Postponement of half and three-quarters, respectively, of 1937 payments approved.

Yuma project, Ariz.—Request for relief denied.

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Substructure Contract Let For Tennessee Bridge

Contract for construction of the substructure of the $1,500,000 Florence-Sheffield bridge over the Tennessee River was awarded March 6 to Hardaway Contracting Co. of Columbus, Ga. by the Alabama highway department. The contract, for the erection of nine concrete piers in the river bed, four bents on either side of the river, and one abutment, was for $218,000.

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Minneapolis Extension Approved by Army

The Chief of Engineers and the Board of Engineers for Rivers and Harbors have approved the plan for extension of the 9-ft. channel of the Mississippi River above St. Anthony's Falls at Minneapolis which was authorized in the River and Harbor Act of 1937. The board believes that the plan presented will provide adequately for development of terminals in the city of Minneapolis.

The report approves plans for extending the channel by dredging at a width of about 150 ft., alteration to bridges and other structures, and construction of two single locks with chambers 56 ft. wide and 400 ft. long and lifts of about 24 and 50 ft.

The cost to the United States for new work would be $7,779,000, with $67,000 annually for maintenance. The approval is conditional upon assurances from local interests that they will bear the cost of necessary bridge modifications and adjustments to utility structures estimated at $1,774,000 and furnish lands and spoil areas needed.

BRIEF NEWS

ONE WING of the new men's residence hall at the University of Colorado has been named for the late Milo S. Ketchum, former dean of the College of Engineering there.

A NEW MAGAZINE, *Photo-Elastic Journal*, devoted "primarily to subjects related to stress, polarized light and plastics," made its first appearance with the January issue. It is to be published monthly by Barsol Publications of New York City.

THE CITY of Memphis has retained Harland Bartholomew & Associates to compile a report on the accomplishments of the city planning program at Memphis and to revise the plan. The Bartholomew organization made the first master plan for the city in 1921.

OLD HARBOR VILLAGE, $6,636,000 federal housing project in Boston, has been leased to the Boston Housing Authority. Average rental on the project has been set at $4.93 per room per month for shelter with an additional average charge of $1.82 per room per month for utilities.

HEADQUARTERS of the American Water Works Association have been moved from the Engineering Societies Building at New York City into larger quarters at 22 East 40th St.

EXPENSES of the Port of New York Authority decreased $127,000 last year at the same time that income and traffic reached new high levels. All charges, including operating expenses and interest, were under 1936. The authority states that of the 50-cent toll charged on its bridges and tunnels, less than nine cents is for operation and maintenance, less than one cent for administration, a little over 20 cents for interest, and 21 cents for sinking and reserve funds for debt retirement.

THE INTERNATIONAL PUBLIC WORKS COMMITTEE, which was set up last October by the governing body of the International Labor Office at Geneva, Switzerland, for the purpose of facilitating exchange of information on public works in various countries, will hold its first meeting in Geneva immediately after the session of the International Labor Conference next June. Like the conference, the committee will be composed of representatives of government, employers, and workers.

THE NEW BRIDGE over the Neches River at Port Arthur, Texas, has been named the Port Arthur-Orange bridge. The bridge, costing $2,750,000, is near completion.

THE STATE HIGHWAY DIRECTOR of Washington can grant contractors extension of time in which to finish their road construction contracts for any "good and just cause," State Attorney General Hamilton stated in a recent ruling.

A STATE HOUSING ACT has been passed by the Virginia state legislature, bringing to 35 the number of states which have enacted legislation permitting cooperation with the federal housing program.

OBITUARY

ALBERT B. KLEWER, 66, engineer and foreman in the bridge division of the city engineering department of Cleveland for many years, died there recently.

EDWARD S. HOUCK, for 30 years construction engineer and directing superintendent for the Dominion Bridge Co., died at Cornwall, Que., March 2.

RALPH A. FELDES, assistant to the vice-president of the New York Central System at Chicago, died March 10, aged 54. Mr. Feldes began service as a bridge engineer in 1905. After his graduation from Armour Institute of Technology with the Chicago Indiana and Southern Railroad, now a part of the New York Central. He rose to the position of chief engineer of the Indiana Harbor Belt Railroad. During the war he was Lieutenant-Colonel of Engineers in France, remaining a year after the war in charge of sale of surplus material.

WALTER A. MURRAY, former street commissioner of Boston, Mass., and at one time chairman of the board, died there March 5.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

AMERICAN SOCIETY OF CIVIL ENGINEERS, Spring meeting, Jacksonville, Fla., April 20-23.

AMERICAN SHORE & BEACH PRESERVATION ASSOCIATION, annual meeting, Washington, D. C., April 19, and Jacksonville, Fla., April 21.

AMERICAN WATER WORKS ASSOCIATION, annual convention, Roosevelt Hotel, New Orleans, April 24-28.

REGIONAL AND LOCAL

MICHIGAN SEWAGE WORKS ASSOCIATION, annual conference, Lansing, Mar. 30-April 1.

MICHIGAN ENGINEERING SOCIETY, annual meeting, Grand Rapids, April 7-9.

CALIFORNIA SEWAGE WORKS ASSOCIATION, annual spring conference, U. S. Grant Hotel, San Diego, April 11.

GREATER NEW YORK SAFETY COUNCIL, annual convention, Hotel Astor, New York City, April 19-21.

AMERICAN SOCIETY OF CIVIL ENGINEERS, Texas Section, spring meeting, Texas State Hotel, Houston, April 29-30.

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION, annual conference, Emerson Hotel, Baltimore, May 19-20.

SECTION MEETINGS, American Water Works Association:
Ky. Tenn., Louisville, March 21-23.
Canadian, Windsor, Ont., Mar. 23-25.
Illinois, Decatur, April 5-6.
Indiana, West Lafayette, April 7-8.
Pacific Northwest, Spokane, May 19-21.

ELECTIONS AND ACTIVITIES

JOHN M. PAGE has been elected president of the Arkansas Society of Engineers. Roy E. Warden is the new vice-president, and Haskell Dickinson has been elected steward.

THE MINNESOTA SURVEYORS' & ENGINEERS' SOCIETY last month elected I. E. Odendahl as president and Arthur F. Stegner as vice-president; J. C. Robbers was elected secretary-treasurer.

GEORGE M. SHEPARD was elected president, H. E. WcWethy vice-president, and J. R. Johnston treasurer of the Minnesota Federation of Architectural and Engineering Societies at its annual convention last month.

W. R. ENGSTROM has been elected president of the Seattle section of the American Society of Civil Engineers. Roy Harris was elected vice president.

C. W. BROWN was elected president of the Mississippi Valley conference of state highway departments at its 30th annual convention. A. C. Tilley was elected secretary of the association.

J. T. HALLETT has been elected president of the Indiana Engineering Council; and T. J. Kelly is the new vice-president.

THE INDIANA SECTION of the American Society of Civil Engineers has chosen Prof. C. A. Ellis as president; Fred Kellam, vice-president; Denzil Doggett, secretary-treasurer; and K. B. Wolfskill, assistant secretary.

THE MISSISSIPPI HIGHWAY CONTRACTORS ASSOCIATION has voted to affiliate with the American Road Builders Association. The Mississippi association has a membership of 70.

OFFICERS elected at the close of the 20th annual Texas Water and Sewage Short School held under the auspices of the American Water Works Association, the Texas State Department of Health, and Texas A. & M. College, were as follows: J. L. Horner, president; V. M. Ehlers, secretary; Mrs. Earl H Goodwin, assistant secretary; A. G. Glassen, D. B. Dickson, S. C. Clark and M. J. Salmon, vice-presidents.

NEWLY ELECTED OFFICERS of the Central Illinois Section of the American Society of Civil Engineers are: Raymond L. Whannel, president; Whitney C. Huntington and Clifford M. Hathaway, vice-presidents; Randolph P. Hoelscher, secretary-treasurer.

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Short Courses

REGIONAL MUNICIPAL TRAINING SCHOOL for water superintendents and water works operators of New York State Municipalities, sponsored by New York State Conference of Mayors, American Water Works Association, and Rensselaer Polytechnic Institute, Cornell University, New York University. Held March 30-April 1 at Rensselaer Polytechnic Institute, Troy, N. Y.; April 6-8, Cornell University, Ithaca; April 13-15, New York University, New York City.

UNIVERSITY OF WISCONSIN, short course for sewage works operators, sponsored by the League of Wisconsin Municipalities, at Madison, April 19-22.

TEXAS A. & M. COLLEGE, short course in highway engineering, directed by the Department of Civil Engineering of the college, in cooperation with Texas Highway Department, College Station, Tex., April 15-16.

PERSONAL

JOHN SWEENEY has been elected city engineer of Paris, Tenn.

LIEUT. COMMDRS. GEORGE D. WELSH, Valentine J. McManus, Hugo C. Fischer, Lewis N. Moeller, and Andrew G. Bisset of the Navy Civil Engineer Corps have been promoted to the rank of commander.

KURTZ BETZ has resigned his position on the engineering staff of the Washington state highway department at Olympia to return to Germany, his native country, where he will join the engineering staff of the highway department.

FRANCISCO GOMEZ-PEREZ has been made assistant to the chief of the designing department of the Mexican National Commission of Irrigation in Mexico City. He was formerly engineer of specifications in the designing department of the commission. Mr. Gomez-Perez is president of the Mexican Association of Engineers and Architects.

GEORGE SHAFFER, highway engineer in charge of District No. 1 of the Arizona highway commission, has resigned effective April 1. Mr. Shaffer has been connected with the highway department for the past 15 years.

GEORGE M. TAPLEY, formerly in charge of the design of Concha Dam in New Mexico, has been transferred to the office of the Chief of Engineers in Washington.

L. C. BUNDY, division bridge engineer for the Arkansas state highway department for the past fifteen years, has resigned effective March 1 to become construction division engineer for the Vincennes Steel Corp. at Vincennes, Ind.

CAPT. H. F. HERTFORD, assistant district engineer of Jacksonville for the U. S. Engineers, is to be transferred in the near future to Paris, France, for duty with the American Battle Monument Commission.

CAPT. CHARLES H. MASON, Corps of Engineers, is to become assistant district engineer at Jacksonville, succeeding Captain Hertford.

J. HUGO JOHNSON, head of the department of electrical engineering at the University of Idaho since 1918, has been made acting dean of the College of Engineering to succeed Dean Ivan C. Crawford, recently resigned.

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